



**US Army Corps
of Engineers**
Walla Walla District

Water Resources Development in Idaho 1995



Lake Coeur d'Alene

WATER RESOURCES DEVELOPMENT IN IDAHO



U.S. ARMY CORPS OF ENGINEERS
WALLA WALLA DISTRICT

1995



This publication is authorized by
the Secretary of the Army
as required by PL 99-662

Foreword

This publication is a revised edition of a similar booklet published in January 1993. It contains information concerning the activities of the U.S. Army Corps of Engineers in connection with the development of Idaho water resources. It concentrates specifically on individual river basins from the Boise River to Pend Oreille. It also provides readers with information about possible future development of the State's water resources.

Sites of existing or proposed projects are identified on the map on the inside back cover.

More detailed information on water resources development by the Corps of Engineers may be obtained by directing inquiries to the appropriate office. Addresses of these offices are listed below:

Division Engineer
U.S. Army Engineer Division
North Pacific
P.O. Box 2870
Portland, OR 97208-2870

District Engineer
U.S. Army Engineer District
Alaska
Pouch 898
Anchorage, AK 99506-0828

District Engineer
U.S. Army Engineer District
Portland
P.O. Box 2946
Portland, OR 97208-2946

Division Engineer
U.S. Army Engineer Division
South Pacific
630 Sansom Street, Room 1216
San Francisco, CA 94111-2206

District Engineer
U.S. Army Engineer District
Walla Walla
201 North Third Avenue
Walla Walla, WA 99362-1876

District Engineer
U.S. Army Engineer District
Sacramento
650 Capitol Mall
Sacramento, CA 95814-4794

District Engineer
U.S. Army Engineer District
Seattle
Box C-3755
Seattle, WA 98124-2255



US Army Corps of Engineers

To Our Readers:

The U.S. Army Corps of Engineers has a long and proud history of applying its expertise in engineering and related disciplines to meet the Nation's needs. Over the years, its activities have evolved; however, since 1824, the central focus of its civil mission has been the development of the Nation's water resources. With an annual program of over \$3 billion for civil projects, the Corps is the Federal Government's largest water resources development agency. The Corps develops projects that have proven to be wise investments. These projects have reduced flood damages; provided safe, low-cost waterborne transportation; generated hydroelectric power; provided water for the public, industry and agriculture; offered opportunities for recreation; and helped the environment. They return to the public benefits that far outweigh their costs.

Corps civil works activities reflect partnership. All Corps projects begin when non-Federal interests see a water-related problem and petition Congress for a solution. Under provisions of the Water Resources Development Act of 1986, once the Corps conducts a reconnaissance study to determine whether a feasible project is likely, these sponsors provide a share of the funding for the feasibility study upon which a project will be based. They also provide a share of the cost of the project's design and construction once Congress has authorized the project and provided construction funds. During the period 1986-1994, non-Federal sponsors signed 286 cooperative agreements with the Department of the Army for cost sharing of project construction.

The Corps engineering expertise and responsiveness has stood the Nation in good stead during times of natural disaster. During 1994, the Corps continued to rehabilitate levees damaged by the Midwest Flood of 1993 and responded to the Northridge, California, earthquake and the floods that ravaged the Southeast.

Whatever challenges arise in the decades ahead, I have no doubt the Army Corps of Engineers will be equal to the task.

Acting Assistant Secretary of the Army
(Civil Works)

To Our Readers:

The U.S. Army Corps of Engineers was founded some 220 years ago to be responsive to the needs of a young nation. While the nature of our work has changed with time, our basic purpose remains — to be responsive to America's needs.

Clearly the Nation's concern for the environment has permeated the Corps. Under the National Environmental Policy Act, environmental considerations are part of the planning of every Corps project; and under the Water Resources Development Act of 1990, environmental stewardship was made a primary Corps mission along with navigation and flood control.

Response to natural disasters offers opportunities for some of the most direct Corps assistance to local communities. From flood fighting, recovery and levee rehabilitation in response to the Midwest Flood of 1993, to emergency water, electrical power, construction and building inspections after the Northridge Earthquake, Corps people have shown courage, commitment, and tenacity.

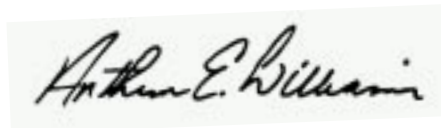
We have continued to enhance our responsiveness to customer needs. For example, the Corps achieved a major cultural shift by instituting a project management system, which assigns one manager to stay with a project from planning through design and construction and to serve as the single point of contact for that project. It has achieved greater accountability to our non-Federal partners and, ultimately, projects which better reflect the needs of the community.

Partnering represents another positive shift in Corps business practices, particularly in civil works construction. A local sponsorship kit walks customers through the complexities of Corps projects. A technique related to partnering, alternative dispute resolution, creates an atmosphere in which the clash of differing viewpoints can transform into creative solutions and prevent costly legal disputes. Pioneered by the Corps, alternative dispute resolution is gaining acceptance throughout the Federal government.

We are active participants in two major interagency efforts. The Interagency Flood Plain Management Review Committee is looking at ways the Federal government can most effectively reduce the risk of flood damage and provide economic benefits and environmental enhancement in flood plains. The Interagency Working Group on the Dredging Process, meanwhile, is establishing better ways to handle the nearly 300 million cubic yards of soil the Corps moves each year from its navigation projects.

And, of course, we still respond to the needs of American families. As one of the Nation's largest providers of outdoor recreation, the Corps welcomes citizens to its 461 lakes and other water resource projects. At 82 shore protection projects, the Corps has provided 226 miles of stable beaches. Recreation and natural resource management are responsibilities we take seriously, and we use the opportunity of a visit to a Corps project to help others appreciate our Nation's valuable and delicate natural resources.

This booklet is one of a series detailing Corps of Engineers water resources programs and projects in the 50 States and in U.S. territories. I hope you will find it interesting and feel pride in ownership of the projects.

A handwritten signature in black ink, reading "Arthur E. Williams". The signature is fluid and cursive, with the first name "Arthur" being more prominent.

ARTHUR E. WILLIAMS
Lieutenant General
Chief of Engineers

IDAHO WATER FACTS

State Water Surface Area.....	880 Square Miles
Number of Lakes.....	More Than 2,000
Largest Lake — Pend Oreille.....	148 Square Miles
Deepest Lake — Pend Oreille.....	More Than 1,100 Feet
Highest Waterfall.....	600 feet, Big Fiddler Creek, Boise River Basin
Miles of Streams and Rivers.....	93,000 Miles
Longest River — Snake River.....	779 Miles
Average Annual Precipitation.....	Varies From Less than 10 to More than 60 Inches
Most Precipitation in 24-Hour Period.....	7.7 inches of rain, Rattlesnake Creek, Idaho, 1909
Annual Stream Inflow to State.....	About 37 Million Acre-feet
Annual Stream Outflow to State.....	About 75 Million Acre-feet
Irrigated Area of State.....	4 Million Acres
Highest Dam.....	Dworshak, North Fork Clearwater, 717 feet
Active Reservoir Storage Capacity.....	12,384,000 Acre-feet
Largest Active Storage Reservoir — Dworshak.....	2,016,000 acre-feet
Snake Plain Aquifer Storage - Top 100 Feet of Aquifer.....	About 100 Million Acre-feet

SOURCE: Idaho Department of Water Resources

Contents

	Page		Page
FOREWORD	i	Andromous Fish Evaluation	
TO OUR READERS	ii	Program (AFEP)	14
IDAHO WATER FACTS	iv	Publication Available	14
CONTENTS	v		
CHAPTER ONE		CHAPTER FOUR	
CIVIL WORKS OVERVIEW	1	MAJOR RIVER BASINS	17
Introduction	1	CHAPTER FIVE	
Authorization and Planning of		SNAKE RIVER MAINSTEM	19
Water Resources Projects	1	The Columbia-Snake Inland	
Navigation	2	Waterway	19
Flood Control and Flood Plain		Hells Canyon, Oxbow, and	
Management	2	Brownlee Dams	20
Shore and Hurricane Protection	3	Lower Granite Lock and Dam,	
Hydropower	3	Lower Granite Lake	20
Water Supply	3	Recreation	21
Recreation	4	Fish and Wildlife	21
Environmental Quality	4	Lewiston-Clarkston Bridge	23
Regulatory Programs	4	Navigation-Lewiston to Johnson Bar	
Emergency Response and Recovery	4	Landing	23
CHAPTER TWO		Blackfoot Area Levees	23
HOW PROJECTS ARE INITIATED	6	Shelley Area Revetment	23
Continuing Authorities	6	Heise Area Levees	24
CHAPTER THREE		Heise-Roberts Levee Extension	24
NORTH PACIFIC DIVISION	8	Jackson-Palisades Project	24
Technical Support Services	9	CHAPTER SIX	
Water Management Division	9	PALOUSE RIVER BASIN	27
Materials Laboratory	9	Basin Studies (Walla Walla District)	27
Hydroelectric Design Center	10	CHAPTER SEVEN	
Regional Issues	10	CLEARWATER RIVER BASIN	29
Comprehensive Basin Studies	10	Basin Studies (Walla Walla District)	29
Lower Snake River Fish and		Mission Creek	29
Wildlife Compensation Plan	10	Lapwai Creek, Culdesac	29
Columbia River and Treaty with		Potlatch River, Kendrick	29
Canada	11	Bear Creek, Kendrick	29
Northwest Power Planning Council	11	Dworshak Dam and Reservoir	29
Andromous Fish	12	Recreation	31
Activities for Salmon	12		
Long-Term Studies	13		
Pacific Salmon Coordination Office	13		

	Page
Dworshak Fish and Wildlife Compensation	31
South Fork Clearwater River Levees	33
 CHAPTER EIGHT	
SALMON RIVER BASIN	35
Tomanovich-Salmon City Levees	35
Salmon River Flood Damage Reduction Study	35
Whitebird Creek Levees at Whitebird	35
 CHAPTER NINE	
WEISER RIVER BASIN	37
Weiser River Flood Protection Project	37
Basin Study	37
Environmental Restoration Project	37
 CHAPTER TEN	
PAYETTE RIVER BASIN	39
Basin Study	39
Payette Valley Flood Protection Project	39
 CHAPTER ELEVEN	
BOISE RIVER BASIN	41
Boise Valley Levees	41
Cottonwood Creek Dam (Deauthorized)	41
Lucky Peak Lake	42
Fish and Wildlife and Recreation	43
Arrowrock and Anderson Ranch Dams	43
Floodplain Management Report	44
Urban Study	44
Lower Boise River and Tributaries Study	44
 CHAPTER TWELVE	
OWYHEE RIVER BASIN: IDAHO, OREGON, AND NEVADA	47
 CHAPTER THIRTEEN	
BIG WOOD RIVER BASIN	49
Gooding Area Flood Protection	49
Basin Study	49

	Page
Soldier Creek Environmental Restoration Project	50
 CHAPTER FOURTEEN	
BIG LOST RIVER BASIN	53
Basin Study	53
 CHAPTER FIFTEEN	
MUD LAKE	55
 CHAPTER SIXTEEN	
PORT NEUF RIVER BASIN	57
Pocatello Levees and Channel Improvements	57
Snagging and Clearing of Rapid Creek through Inkom	57
Basin Survey	57
Portneuf River Environmental Restoration Project	58
 CHAPTER SEVENTEEN	
BLACKFOOT RIVER BASIN	61
Levees	61
Blackfoot Reservoir Modifications	61
 CHAPTER EIGHTEEN	
WILLOW CREEK BASIN	63
Ririe Dam and Lake	63
Basin Survey	63
 CHAPTER NINETEEN	
LYMAN CREEK BASIN	65
Levees	65
 CHAPTER TWENTY	
HENRY'S FORK RIVER BASIN	67
 CHAPTER TWENTY-ONE	
BEAR RIVER BASIN	69
Basin Survey (Sacramento District)	69

	Page
CHAPTER TWENTY-TWO	
SPOKAN RIVER BASIN	71
Coeur d'Alene Lake (Seattle District)	71
St. Maries, St. Joe River (Seattle District)	71
Spokane River and Tributaries, Idaho and Washington (Seattle District)	71
Placer Creek (Seattle District)	71
CHAPTER TWENTY-THREE	
PENDORE ILLER RIVER BASIN	73
Albeni Falls Dam (Seattle District)	73
Recreation	74
Clark Fork, Lightning Creek (Seattle District)	74
Clark Fork-Flathead River Basin (Seattle District)	74
Planning Assistance to the State of Idaho: Priest Lake Outlet Structure Study	75
CHAPTER TWENTY-FOUR	
KOOTENAI RIVER BASIN	77
Kootenai River Drainage (Seattle District)	77
Libby Recreation Areas	78
CHAPTER TWENTY-FIVE	
INDEPENDENT PROJECTS	81
Little Wood River	81
Swan Falls	81
C.J. Strike	81
Bliss	81
Lower Salmon	81
Upper Salmon	81
Milner	81
Minidoka	81
American Falls	82
Devil Creek	82
GLOSSARY	83
INDEX	86
CIVIL WORKS MAP	88

CHAPTER ONE

Civil Works Overview

Introduction

From 1775 to the present, the U.S. Army Corps of Engineers has served the Nation in peace and war. The Corps traces its history to June, 1775, when the Continental Congress appointed Colonel Richard Gridley as Chief of Engineers of the Continental Army, under General George Washington. The original Corps was the Army's engineering and construction arm until it mustered out of service at the close of the Revolutionary War in 1783.

In 1802, Congress re-established a separate Corps of Engineers within the Army. At the same time, it established the U.S. Military Academy at West Point, New York, on the Hudson River; the country's first—and for 20 years its only—engineering school. With the Army having the nation's most readily available engineering talent, successive Congresses and administrations established a role for the Corps as an organization to carry out both military construction and works “of a civil nature.”

Throughout the nineteenth century, the Corps supervised the construction of coastal fortifications, lighthouses, several early railroads, and many of the public buildings in Washington, D.C., and elsewhere. Meanwhile, the Corps of Topographical Engineers, which enjoyed a separate existence for 25 years (1838-1863), mapped much of the American West. Army Engineers served with distinction in war, with many engineer officers rising to prominence during the Civil War.

In its civil role, the Corps of Engineers became increasingly involved with river and harbor improvements, carrying out its first harbor and jetty work in the first quarter of the nineteenth century. The Corps' ongoing responsibility for Federal river and harbor improvements dates from 1824, when Congress passed two acts authorizing the Corps to survey roads and canals and to remove obstacles on the Ohio and Mississippi Rivers. Over the years since, the expertise gained by the Corps in navigation projects led succeeding administrations and Congresses to assign new water-related missions to the Corps in such areas as flood control, shore and hurricane protection, hydropower, recreation, water supply and quality, and wetlands protection.

Today's Corps of Engineers carries out missions in three broad areas: military construction and engineering support to military installations; reimbursable support to other Federal agencies (such as the Environmental Protection Agency's “Superfund” program to clean up hazardous and toxic waste sites); and the Civil Works mission, centered around navigation, flood control and—under the Water Resources Development Acts of 1986, 1988, 1990, 1992—a growing role in environmental restoration.

Authorization and Planning of Water Resources Projects

Corps of Engineers water resources activities are normally initiated by non-Federal interests, authorized by Congress, funded by a combination of Federal and non-Federal sources, constructed by the Corps under the Civil Works Program, and operated and maintained either by the Corps or by a non-Federal sponsoring agency.

The Water Resources Development Act of 1986 made numerous changes in the way potential new water resources projects are studied, evaluated and funded. The major change is that the law now specifies greater non-Federal cost sharing for most Corps water resources projects.

When local interests feel that a need exists for improved navigation, flood protection, or other water resources development, they may petition their representatives in Congress. A Congressional committee resolution or an act of Congress may then authorize the Corps of Engineers to investigate the problems and submit a report. Water resources studies, except studies of the inland waterway navigation system, are conducted in partnership with a non-Federal sponsor, with the Corps and the sponsor jointly funding and managing the study.

For inland navigation and waterway projects, which are by their nature not “local,” Congress, in the Water Resources Development Act of 1986, established an Inland Waterway Users Board, comprised of waterway transportation companies and shippers of major commodities. This board advises the Secretary of the Army and makes recommendations on priorities for new

navigation projects such as locks and dams. Such projects are funded in part from the Inland Waterway Trust Fund which, in turn, is funded by waterway fuel taxes.

Normally, the planning process for a water resource problem starts with a brief reconnaissance study to determine whether a project falls within the Corps' statutory authority and meets national priorities. Should that be the case, the Corps district where the project is located will carry out a full feasibility study to develop alternatives and select the best possible solution. This process normally includes public meetings to determine the views of local interests on the extent and type of improvements desired. The Federal, state, and other agencies with interests in a project are partners in the planning process.

Before making recommendations to Congress for project authorization, the Corps ensures that the proposed project's benefits will exceed costs, its engineering design is sound, the project best serves the needs of the people concerned, and that it makes the wisest possible use of the natural resources involved while adequately protecting the environment.

Once the Corps of Engineers district completes its feasibility study, it submits a report, along with a final environmental impact statement, to higher authority for review and recommendations. After review and coordination with all interested Federal agencies and the governors of affected states, the Chief of Engineers forwards the report and environmental statement to the Secretary of the Army, who obtains the views of the Office of Management and Budget before transmitting these documents to Congress.

If Congress includes the project in an authorization bill, enactment of the bill constitutes authorization of the project. Before construction can get underway, however, both the Federal government and the project sponsor must provide funds. A Federal budget recommendation for a project is based on evidence of support by the state and the ability and willingness of a non-Federal sponsor to provide its share of the project cost.

Appropriation of money to build a particular project is usually included in the annual Energy and Water Development Appropriation Act, which must be passed by both Houses of the Congress and signed by the President.

Navigation

Corps of Engineers involvement in navigation projects dates to the early days of the United States, when rivers and coastal harbors were the primary paths of commerce in the new country. Without its great

rivers, the vast, thickly-forested, region west of the Appalachian Mountains would have remained impenetrable to all but the most resourceful early pioneers. Consequently, western politicians such as Henry Clay agitated for Federal assistance to improve rivers. At the same time, the War of 1812 showed the importance of a reliable inland navigation system to national defense.

There was, however, a question as to whether transportation was, under the Constitution, a legitimate Federal activity. This question was resolved when the Supreme Court ruled that the Commerce Clause of the Constitution granted the Federal government the authority, not only to regulate navigation and commerce, but also to make necessary navigation improvements.

The system of harbors and waterways maintained by the Corps of Engineers remains one of the most important parts of the nation's transportation system. The Corps maintains the nation's waterways as a safe, reliable and economically efficient navigation system. The 12,000 miles of inland waterways maintained by the Corps carry one-sixth of the nation's inter-city cargo. The importance of the Corps mission in maintaining depths at more than 500 harbors, meanwhile, is underscored by an estimated one job in five in the United States being dependent, to some extent, on the commerce handled by these ports.

Flood Control and Flood Plain Management

Federal interest in flood control began in the alluvial valley of the Mississippi River in the mid-19th century. As the relationship of flood control and navigation became apparent, Congress called on the Corps of Engineers to use its navigational expertise to devise solutions to flooding problems along the river.

After a series of disastrous floods affecting wide areas in the 1920's and 30's, Congress determined, in the Flood Control Act of 1936, that the Federal government would participate in the solution of flooding problems affecting the public interest that were too large or complex to be handled by states or localities. Corps authority for flood control work was thus extended to embrace the entire country. The Corps turns most of the flood control projects it builds over to non-Federal authorities for operation and maintenance once construction is completed.

The purpose of flood control work is to prevent damage through regulation of the flow of water and other means. Prevention of flood-related damages can be accomplished with structural measures, such as reservoirs, levees, channels and floodwalls that modify

the characteristics of floods; or non-structural measures, such as flood plain evacuation, floodproofing and floodway acquisition, that alter the way people use these areas and reduce the susceptibility of human activities to flood risk.

Corps flood control reservoirs are often designed and built for multiple-purpose uses, such as municipal and industrial water supply, navigation, irrigation, hydro-electric power, conservation of fish and wildlife, and recreation.

The Corps fights the nation's flood problems not only by constructing and maintaining structures, but also by providing detailed technical information on flood hazards. Under the Flood Plain Management Services Program, the Corps provides, on request, flood hazard information, technical assistance and planning guidance to other Federal agencies, states, local governments and private citizens.

Once community officials know the flood-prone areas in their communities and how often floods would be likely to occur, they can take necessary action to prevent or minimize damages to existing and to new buildings and facilities, such as adopting and enforcing zoning ordinances, building codes, and subdivision regulations.

The Flood Plain Management Services Program provides assistance to other Federal and State agencies in the same manner.

Shore and Hurricane Protection

Corps work in shore protection began in 1930, when Congress directed the Corps to study ways to reduce erosion along U.S. seacoasts and the Great Lakes. Hurricane protection work was added to the erosion control mission in 1955, when Congress directed the Corps to conduct investigations along the Atlantic and Gulf Coasts to identify problem areas and determine the feasibility of protection.

While each situation the Corps studies involves different considerations, Corps engineers always consider engineering feasibility and economic efficiency along with the environmental and social impacts. Federal participation in a shore protection project varies, depending on shore ownership, use and type and frequency of benefits. (If there is no public use or benefit, the Corps will not recommend Federal participation.) Once the project is complete, non-Federal interests assume responsibility for its operation and maintenance.

Eighty-two Federal shore protection projects along the coasts of the Atlantic, Pacific, Gulf of Mexico and the Great Lakes protect a total of 226 miles of shoreline. Total investment in these projects since 1950 has been

\$674 million, of which \$405 million was provided by the Federal government, the rest by non-Federal sponsors.

One shore protection method popular in seaside communities is beach nourishment—the periodic replenishment of sand along the shoreline to replace that lost to storms and erosion. Authorized nourishment projects usually have a nourishment period of 50 years. In addition, Section 145 of the Water Resources Development Act of 1976 authorizes placement of beach quality sand from Corps dredging projects on nearby beaches. Under Section 933 of the Water Resources Development Act of 1986, local sponsors pay the Federal government 50 percent of the additional costs of this sand placement.

Hydropower

The Corps has played a significant role in meeting the Nation's electric power generation needs by building and operating hydropower plants in connection with its large multiple-purpose dams. The Corps' involvement in hydropower generation began with the Rivers and Harbors Acts of 1890 and 1899, which required the Secretary of War and the Corps of Engineers to approve the sites and plans for all dams and to issue permits for their construction. The Rivers and Harbors Act of 1909 directed the Corps to consider various water uses, including water power, when submitting preliminary reports on potential projects.

The Corps continues to consider the potential for hydroelectric power development during the planning process for all water resources projects involving dams and reservoirs. In most instances today, it is non-Federal interests who develop hydropower facilities at Corps projects without Federal assistance. The Corps, however, can plan, build and operate hydropower projects when it is impractical for non-Federal interests to do so.

Today, the more than 20,000 megawatts of capacity at Corps-operated power plants provide approximately 24 percent of the Nation's hydroelectric power, or 3 percent of its total electric energy supply.

Water Supply

Corps involvement in water supply dates back to 1853 when it began building the Washington Aqueduct, which provides water to the Nation's capital city and some of its suburbs to this day.

Elsewhere in the nation, the Water Supply Act of 1958 authorized the Corps to provide additional storage in its reservoirs for municipal and industrial water

supply at the request of local interests who must agree to pay the cost.

The Corps also supplies water for irrigation under terms of the Flood Control Act of 1944. This act provided that the Secretary of War, upon the recommendation of the Secretary of the Interior, could allow use of Corps reservoirs for irrigation, provided that users agree to repay the government for the water.

Recreation

The Flood Control Act of 1944, the Federal Water Project Recreation Act of 1965, and language in specific project authorization acts authorize the Corps to construct, maintain, and operate public park and recreational facilities at its projects and to permit others to build, maintain, and operate such facilities. The water areas of Corps projects are open to public use for boating, fishing, and other recreational purposes.

The Corps of Engineers today is one of the Federal Government's largest providers of outdoor recreational opportunities, operating more than 4,300 sites at its lakes and other water resource projects. More than 370 million visits per year are recorded at these sites. State and local park authorities and private interests operate nearly 2,000 of these areas at Corps projects.

Environmental Quality

The Corps carries out the Civil Works Programs in consistency with many environmental laws, executive orders and regulations. Perhaps primary among these is the National Environmental Policy Act (NEPA) of 1969. This law requires Federal agencies to study and consider the environmental impacts of their proposed actions.

Consideration of the environmental impact of a Corps project begins in the early stages and continues through design, construction and operation of the project. The Corps must also comply with these environmental laws and regulations in conducting its regulatory programs.

The NEPA procedures ensure that public officials and private citizens may obtain and provide environmental information before Federal agencies make decisions concerning the environment. In selecting alternative project designs, the Corps strives to choose options with minimum environmental impact.

The Water Resources Development Act of 1986 authorizes the Corps to propose modifications of its existing projects—many of them built before current environmental requirements were in effect—for environmental improvement. Proposals the Corps has made under this authority range from use of dredged material to create nesting sites for waterfowl to

modification of water control structures to improve downstream water quality for fish.

In recent years the Corps of Engineers has planned and recommended environmental restoration actions at Federal projects to restore environmental conditions.

Regulatory Programs

The Corps of Engineers regulates construction and other work in navigable waterways under Section 10 of the Rivers and Harbors Act of 1899 and has authority over the discharge of dredged or fill material into the “waters of the United States”—a term which includes wetlands and all other aquatic areas—under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500, the “Clean Water Act”). Under these laws, those who seek to carry out such work must first receive a permit from the Corps.

The “Section 404” program is the principal way by which the Federal government protects wetlands and other aquatic environments. The program's goal is to ensure protection of the aquatic environment while allowing for necessary economic development.

The permit evaluation process includes a public notice and a public comment period. Applications for complex projects may also require a public hearing before the Corps makes a permit decision. In its evaluation of applications, the Corps is required by law to consider all factors involving the public interest. These may include economics, environmental concerns, historical values, fish and wildlife, aesthetics, flood damage prevention, land use classifications, navigation, recreation, water supply, water quality, energy needs, food production and the general welfare of the public.

The Corps of Engineers has issued a number of nationwide general permits, mostly for minor activities which have little or no environmental impact. Individual Corps districts have also issued regional permits for certain types of minor work in specific areas. Individuals who propose work that falls under one of these general or regional permits need not go through the full standard individual permit process. However, many general permit authorizations do involve substantial effort by the Corps and often require project-specific mitigation for the activities authorized by the permit. Corps districts have also issued State Program General Permits for work in states that have comprehensive wetland protection programs. These permits allow applicants to do work for which they have received a permit under the state program. These general permits reduce delays and paperwork for applicants and allow the Corps to devote most of its resources to the more significant cases while

maintaining the environmental safeguards of the Clean Water Act.

Emergency Response and Recovery

The Corps provides emergency response to natural disasters under Public Law 84-99, which covers flood control and coastal emergencies. It also provides emergency support to other agencies, particularly the Federal Emergency Management Agency (FEMA), under Public Law 93-288 (the Stafford Act) as amended.

Under Public Law 84-99, the Chief of Engineers, acting for the Secretary of the Army, is authorized to carry out disaster preparedness work; advance measures; emergency operations such as flood fighting, rescue and emergency relief activities; rehabilitation of flood control works threatened or destroyed by flood; and protection or repair of Federally authorized shore protection works threatened or damaged by coastal storms. This act also authorizes the Corps to provide emergency supplies of clean water in cases of drought or contaminated water supply. After the immediate flooding has passed, the Corps provides temporary construction and repairs to essential public utilities and facilities and emergency access for a 10-day period, at the request of the governor and prior to a Presidential Disaster Declaration.

Under the Stafford Act and the Federal Response Plan, the Corps of Engineers, as designated by the Department of Defense, is responsible for providing public works and engineering support in response to a major disaster or catastrophic earthquake. Under this plan, the Corps, in coordination with FEMA, will work directly with state authorities in providing temporary repair and construction of roads, bridges, and utilities; temporary shelter; debris removal and demolition; water supply, *etc.* The Corps is the lead Federal agency tasked by FEMA to provide engineering, design, construction and contract management in support of recovery operations.

CHAPTER TWO

How Projects Are Initiated

The Corps of Engineers functions as an engineer consultant to Congress. Most Corps water resource projects are developed under specific congressional authorization.

When local interests believe a need exists for construction or improvement of a water resource project, they petition their representatives in Congress. The senator or representative then requests the appropriate congressional committee to direct the Corps to conduct a study and furnish a recommendation.

Authority for a study is either by appropriate Senate or House Committee Resolution or by Congressional Act.

Economic and engineering solutions to the problem and possible impact on the environment are studied. In making the study, public meetings are held to determine the wishes of local interests.

Desires of local interests are fundamental not only because of construction effects on the local area, but because the law (Public Law 99-662) requires local interests to provide real estate and/or financial participation in the project.

All interested Federal and non-Federal agencies are contacted to obtain their views, avoid conflict with their programs, and, if appropriate, to incorporate features of their programs into Corps projects. Then all the data are analyzed and potential alternatives evaluated under criteria specified in the Principle and Guidelines. The study, with its recommendations, is submitted to Congress which may then authorize a project. After being authorized, the project still requires congressional funding before construction can begin.

Some studies may be confined to a small area with a comparatively simple solution. Other studies may involve an urban area or cover an entire river basin and require detailed analyses of navigation, flood control, erosion control, hurricane and flood protection, water supply, water quality control, hydroelectric power, major drainage, irrigation, recreation or other purposes that may be deemed necessary to promote national welfare.

After Congress provides construction funds, the Corps prepares plans and specifications, awards contracts, and supervises construction. Completed projects may be operated and maintained by the Corps or they may be transferred to another agency or local interests.

Continuing Authorities

In addition to major water resources development projects authorized directly by Congress, the Corps may construct small projects and emergency work. This work is performed under special continuing authorities established by Congress, with general funds appropriated annually. The projects are subject to the same evaluation criteria and local cooperation requirements as congressionally authorized projects. The Chief of Engineers, under the direction of the Secretary of the Army and without further congressional authority, may authorize and construct those small projects that are complete in themselves and do not commit the United States to any additional improvement to ensure successful operation.

Small Flood Control Projects (Section 205, Flood Control Act of 1948, as amended). Small flood control projects not specifically authorized by Congress may be constructed under authority given the Chief of Engineers. The Federal share of such projects may not exceed \$5 million. The work must be a complete solution to the flood problem involved, so as not to commit the United States to additional improvements to ensure effective operation.

Small Navigation Projects (Section 107, 1960 River and Harbor Act, as amended). This legislation authorizes the Corps of Engineers to construct small channel and harbor improvement projects not specifically authorized by Congress. The Federal share in such projects may not exceed \$4 million. These projects must be complete in themselves and not commit the United States to any additional improvement to ensure successful operation.

Mitigation of Shore Damage Attributable to Navigation Works (Section 111, River and Harbor Act of 1968). This act authorizes the Corps to investigate, study, and construct projects for the prevention or mitigation of shore damage attributable to Federal navigation works. Congressional authorization is required for construction of projects which exceed a first cost of \$2 million.

Small Beach Erosion Control Projects (Section 103, River and Harbor Act of 1962, as amended). Small beach restoration and protection projects not specifically authorized by Congress are constructed under this authority. The Federal share of the cost must not exceed

\$2 million for a single project, and the project must not be dependent on additional improvements for success.

Snagging and Clearing (Section 2, Flood Control Act of 1937, as amended by Section 208, 1954 Flood Control Act). The Corps of Engineers is authorized under this act to remove accumulated snags and debris, along with clearing and straightening navigable channels. Up to \$500,000 can be expended on any single tributary during one fiscal year in the interest of flood control. Each project must constitute a complete solution to the problem.

Emergency Bank Protection (Section 14, Flood Control Act of 1946, as amended). Under this act the Corps of Engineers is authorized to provide the repair, restoration, and modification of emergency stream bank and shoreline protection to prevent damages to highways, bridge approaches and other public works. The Corps of Engineers is authorized to spend up to \$500,000 at a single locality.

Flood Fighting, Repair, and Rescue Work (Public Law 84-99, 84th Congress). This law authorizes the Corps of Engineers to engage in flood fighting and rescue operations and to repair or restore any flood control work threatened or destroyed by flood.

Snagging and Clearing (Section 3 of Public Law 14, River and Harbor Act of 1945). This act authorizes emergency work by the Corps of Engineers to clear or remove unreasonable obstructions in navigable portions of rivers, harbors and other waterways and tributaries in the interest of emergency navigation and flood control.

Natural Disaster Assistance (Public Law 93-288, 93rd Congress). Under this law, the Corps of Engineers is authorized to cooperate with FEMA to provide assistance to state and local governments in dealing with natural disasters. Such assistance includes work essential for the preservation and protection of life and property; conducting damage survey investigations; repairing, restoring or replacing public road facilities; and providing technical and engineering services. This law supersedes and incorporates provisions of Public Law 606, 91st Congress, as amended.

Small Water Resource Development Projects (Section 201, Flood Control Act of 1965). This special authority can expedite the authorization of small projects. A resolution of the Committees on Public Works of the Senate and/or House of Representatives can authorize a project directly, rather than including the authorization in a water resources development bill. For such projects, the Corps is authorized to construct, operate, and maintain both single and multipurpose projects involving, but not limited to navigation, flood control, and shore protection. The estimated Federal first cost of these projects must be less than \$15 million.

Comprehensive Planning Cooperation (Section 22 of Public Law 93-251, Water Resources Development Act of 1974). This act authorizes the Secretary of the Army, acting through the Chief of Engineers, to cooperate with any state in the preparation of comprehensive plans for the development, utilization and conservation of the water and related resources of drainage basins located within the boundaries of that state. The Secretary is also authorized to submit to Congress reports and recommendations of appropriate Federal participation in carrying out such plans. The Federal share in such plans is limited to \$300,000 annually in any one state.

Shoreline Erosion Control Demonstration Act of 1974 (Section 54 of Public Law 93-251, Water Resources Development Act of 1974). This act provides for the establishment of a national shoreline erosion control development and demonstration program.

Columbia River Treaty Fishing Access Sites (Public Law 100-581, Title IV, November 1988). The Secretary of the Army is directed to administer and improve certain sites to provide access for Indian treaty fishermen. Implementation of this law requires the Secretary to undertake a wide range of land management acquisition and development actions. These actions affect land along Bonneville, The Dalles, and John Day pools on the Columbia River in Oregon and Washington. The law directs the Secretary to transfer these lands, following their development, to the Secretary of the Interior for long-term management for treaty fishing use. The law provides a vehicle for the United States to satisfy its commitment to the Indian tribes which exercise treaty fishing rights in the Columbia River and whose fishing sites were inundated by construction of Bonneville Dam.

The history of this public law may be interpreted as providing that the specified fishing sites are to be restricted for the use of the Treaty Tribes. Many of these sites are within or adjacent to public recreation areas that have existed for many years. Agreement has been reached with the Treaty Tribes concerning public use of the recreation areas affected by the law. During the recreation season, the Treaty Tribes will share the use of these areas. Further negotiations are underway to deal with the period of time which follows. Negotiations will address use and management during this period and will lead to development plans for affected lands.

CHAPTER THREE

North Pacific Division

The mission of the U.S. Army Corps of Engineers (Corps) is to provide quality, responsive engineering service to the nation. The Corps plans, designs, builds, and operates water resources and other civil works projects; provides military construction for the Army and Air Force; and provides design construction management support for other Federal agencies.

The Corps' environmental work is extensive and includes ecosystem restoration across the nation; clean up of toxic and hazardous wastes, and the permit program which regulates the deposit of dredged and fill material into navigable waterways and wetlands.

In the Civil Works Program, the Corps operates and maintains almost 300 deep draft harbors, 75 hydro-power projects, 275 locks, and 12,000 miles of navigable waterways. The 383 lakes and reservoirs and 8,500 miles of levees managed by the Corps prevented \$17 billion in damages in 1994. Since 1928, over \$292 billion in damages have been prevented. During Fiscal Year 1995, the Corps spent \$414 million on civil

works environmental activities such as Everglades restoration and regulating work in wetlands.

The Corps owns and operates 24 percent of United States hydropower capacity and in 1994 generated 68.2 billion kilowatt-hours. The multipurpose reservoirs and other facilities operated by the Corps includes 4,329 recreation sites which hosted 385 million visits during 1995.

The Corps of Engineers has eight regional offices, called divisions, throughout the United States. These divisions manage Corps civil works activities accomplished by districts which are based on river basins rather than state boundaries.

In the Pacific Northwest and Alaska, the Corps, North Pacific Division in Portland, Oregon, directs the civil works activities of four district offices. The area of responsibility of the three district offices located in Portland, Oregon, and in Seattle and Walla Walla, Washington, includes all or portions of the seven western states located in the Columbia River Basin.



North Pacific Division headquarters, Portland, Oregon

The fourth district office at Anchorage, Alaska, has civil works responsibility for the entire State.

With an area of 880,000 square miles, the North Pacific Division encompasses nearly one-fourth of the total land area of the United States. With the vast stretches of Alaskan shoreline, added to that of Washington and Oregon, the North Pacific Division includes more than 60 percent of the country's tidal coastline. Though vast in size, the region's population represents about 5 percent of the national total.

The North Pacific Division headquarters provides guidance, oversight, and assistance to its districts to assure that the various water resources missions are accomplished in the Federal interest and to the satisfaction of customers. The Division headquarters also performs a major regional interface role with Federal, State, and local governmental interests in the coordination of technical, policy, and budgetary matters affecting the water resources of the Pacific Northwest and Alaska.

Technical Support Services

Water Management Division

The Water Management Division is responsible for managing the system of Corps reservoirs in the Columbia River Basin. This is accomplished through developing, coordinating, and implementing reservoir operation plans which balance the competing demands for water in the basin. Because of the interconnection with many non-Corps projects, this effort also encompasses both Federal and non-Federal reservoirs in the basin owned and operated by various interests. Altogether, some 75 projects are involved.

The Reservoir Control Center in the Water Management Division manages the day-to-day regulation of the projects for flood control, navigation, power generation, recreation, fish and wildlife, and other purposes. Utilizing weather, streamflow, and project data, along with forecasts of future streamflow and operational conditions, the Reservoir Control Center develops regulation strategies for the system based on operating plans, then issues operating instructions to the operators of the dams. Close coordination with agencies and individuals affected by any operation is important to ensure that the best interests of the public are being served. The center also requests releases from the Canadian reservoirs under the terms of the Columbia River Treaty, discussed later in this section.

Other units in the Water Management Division have specialties in hydropower operations, planning, hydropower economics, flood control, water quality, and river forecasting. They prepare studies that establish

long-term operating plans and reservoir operating criteria, and make analyses to address operating concerns such as fish survival and mitigation. As with the day-to-day operations, extensive coordination is also required for long-term planning. This includes the Northwest electrical utility industry, environmental agencies, and other water resource agencies, often through established regional coordinating entities such as the Northwest Power Pool, the Pacific Northwest Coordination Agreement, the Columbia River Treaty, and the Columbia River Water Management Group.

Another important function of the Water Management Division is chairing the In-Season Technical Management Team (TMT), an adaptive management approach to implementing special Federal Columbia/Snake River system operations during the juvenile salmon outmigration. The TMT is composed of Federal managers from the National Marine Fisheries Service, the Bureau of Reclamation, Bonneville Power Administration, U.S. Fish and Wildlife Service, and the Corps. It meets at least weekly during the migration season and provides a forum to receive recommendations from the Federal fisheries agencies as well as State and tribal fishery interests.

Still another function occurs during periods of high runoff, during which the Water Management Division ensures that the Corps' responsibilities for flood control in the basin are being met. It also works with the Bonneville Power Administration to manage the system to maximize production of hydroelectric power for the region and, when possible, for export to other regions in the West. When low runoff occurs, the Water Management Division's work is often more critical since a careful balancing of all water uses is needed to minimize adverse impacts associated with drought conditions.

Materials Laboratory

The Materials Laboratory, 15 miles east of Portland, at Troutdale, Oregon, provides testing services for Corps investigations, design, and construction. Since it began testing in 1948, the laboratory has performed studies on more than 50 major dams and powerhouses.

Three departments conduct tests on soil, rock, concrete, paint, oil, asphalt, and other construction materials. They also provide technical advice on construction material used for both civil and military projects. The laboratory performs quality analyses for potable water, pollution surveillance in rivers and reservoirs, and Environmental Protection Agency quality assurance programs for chemical water analysis.

The laboratory not only performs testing for districts within the North Pacific Division, but also works for

other government organizations and, when commercial facilities are not available, for private firms.

Hydroelectric Design Center

The Hydroelectric Design Center began with the design of the first powerhouse at Bonneville Dam. The initial units started generating power in June 1938. With the forecast for development of the Columbia River Basin and the consequent number of powerhouses to be designed, hydroelectric design for the North Pacific Division was centralized in the Hydroelectric Design Branch in 1948. The center has since designed 32 major powerhouses.

In 1980, as part of a centralized design concept, the Chief of Engineers established the North Pacific Divisions's Hydroelectric Design Center (HDC) as the sole center of hydropower design expertise for the Corps. In addition, the HDC is also responsible for the design of large pumping stations. The center's personnel perform structural, electrical, and mechanical design for hydroelectric powerhouses, equipment procurement, and preparation of construction plans and specifications. Today, the bulk of their work goes towards modernization and rehabilitation of the Corps' aging hydroelectric facilities.

Regional Issues

Comprehensive Basin Studies

The North Pacific Division has been responsible for directing and overseeing basin-wide comprehensive studies undertaken by the Corps in the Pacific Northwest and Alaska. The Division office also coordinates Corps input and involvement in interagency studies under the direction of other agencies or states. At present, the most significant comprehensive basin wide study is the System Operation Review (SOR).

As one of the most highly developed and complex river systems in the world, the Columbia River System serves a broad spectrum of users. Through the SOR, the Corps, Bureau of Reclamation, and Bonneville Power Administration have evaluated this system of Federal projects—many of which were authorized or constructed 20 or more years ago—to determine how best to meet today's needs and provide a long-term strategy for system operation.

The study team has produced an Environmental Impact Statement (EIS) describing the expected effects of alternative operation strategies for the Federal hydropower system on all uses. Many of the system operating strategies in the SOR focus on anadromous fish recovery.

The SOR goals are to provide:

- A comprehensive review of Columbia River System operations including 14 major Federal projects on the Columbia River and its major tributaries.
- A strategy for future operations in view of the needs of all users; and
- Support for a future Federal decision on key power agreements—the Pacific Northwest Coordination Agreement and the Canadian Entitlement Allocation Agreements.

Early in the SOR, Endangered Species Act petitions and listings of endangered and threatened salmon species influenced the scope and direction of the review. The preferred system operation strategy alternative mirrors recommendations of the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service in their biological opinions on salmon recovery plans.

Lower Snake River Fish and Wildlife Compensation Plan

The Lower Snake River Fish and Wildlife Compensation Plan was authorized by the Water Resources Development Act of 1976. The purpose of the plan is to mitigate losses caused to fishery resources and wildlife habitat attributed to construction and operation of the four lower Snake River lock and dam projects (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite).

The compensation plan calls for construction of 10 chinook salmon and steelhead trout hatcheries in Idaho, Oregon, and Washington that will provide 27 million juvenile fish. These fish will be released into the Snake River drainage for migration to the Pacific Ocean. As returning adults, these fish will provide both sport and commercial fishing opportunities with more than 4 million pounds of fish going to the commercial fisheries. An estimated 132,000 adult fish will return to the project area of the lower Snake River and provide approximately 689,000 additional angler days of sport fishing. In addition to the anadromous fish, 93,000 pounds of trout will be reared and released in eastern Washington and Idaho tributary streams to provide 45,000 additional angler days of sport fishing.

Initial project funding was received in fiscal year 1978. Total federal costs through September 1995 were \$214,292,000 for hatchery and off-project fish and wildlife habitat acquisition. The estimated total cost of the compensation plan is \$232 million.

Hatcheries and companion satellite facilities completed and operating in Idaho to enhance specified fish are the following: Clearwater Hatchery near Ahsahka for steelhead trout with its Crooked River Satellite near

Grangeville, Red River Satellite near Elk City, and Powell Satellite near Lolo (Montana) for spring chinook salmon; Dworshak National Hatchery near Ahsahka for spring chinook salmon; Hagerman National Hatchery near Hagerman for steelhead trout; Magic Valley Hatchery near Buhl for steelhead trout; McCall Hatchery near McCall and its South Fork Satellite near Cascade for summer chinook salmon; Sawtooth Hatchery near Stanley and its East Fork Satellite near Clayton for spring chinook salmon; and Eagle Laboratory near Eagle.

Additional facilities are located in Oregon: Lookingglass Creek Hatchery near Elgin and its Imnaha Satellite near Imnaha for spring chinook salmon; and Irrigon Hatchery near Irrigon with its Wallowa Satellite near Enterprise, Little Sheep Creek Satellite near Joseph, and Big Canyon Satellite near Minam for steelhead trout.

Washington locations are the following: Lyons Ferry Hatchery near Starbuck for steelhead trout, rainbow trout, and spring and fall chinook salmon; Satellite facilities are at Dayton Pond and Curl Lake near Dayton, and Cottonwood Creek near Anatone; and Tucannon Hatchery near Dayton for rainbow trout and spring chinook salmon.

The Compensation Plan authorized acquisition of an aggregate of lands in fee or easement for fisherman access, wildlife habitat, and hunting access. Off-project land acquisition is 100 percent complete. The Ahsahka Public Fishing Area has been developed. Development plans for the Myrtle Beach and Magill Public Fishing areas are scheduled for construction during 1996. Hunting access development continues at Windmill, Revere, Shumaker, Pintler Creek, Harstock, Fisher Gulch, and Campbell.

Columbia River Treaty with Canada

The Columbia River Basin spans the boundaries between the United States and Canada. To address jurisdictional and operating problems, the United States and Canada signed the Columbia River Treaty in 1961. It was ratified by Canada 3 years later. The pact provided for the construction of three dams in Canada—Mica, Hugh Keenleyside and Duncan—and for the United States to construct Libby Dam on the Kootenai River in Montana. The treaty provides that 15.5 million acre-feet of storage space be allocated for power production and 8.45 million acre-feet reserved for flood control storage in Canadian reservoirs.

The treaty ensures Canada will operate storage features to provide downstream flood control and optimum power generation in the Basin. Libby Dam reservoir, Lake Koocanusa, extends 42 miles into British Columbia. Canada assumed all costs of construc-

tion for that part of the reservoir. All four of the projects under the treaty are constructed and in operation.

In return for constructing and operating the three Canadian projects, Canada was paid a onetime, lump-sum payment of \$64.4 million for 50 percent of the flood damages prevented in the United States during the 60-year life of the treaty. Canada also receives one half of the power produced downstream in the United States as a result of the added Canadian storage.

Canada sold its share of this power to the United States for \$254 million for a 30-year period. The Columbia Storage Power Exchange (CSPE), a nonprofit United States corporation, was established for the purchase. Power is divided among 41 public and private utilities. Participants' shares range from 0.5 to 17.5 percent. These power allocation agreements phase out in stages from 1998 through 2003. After 2003 the United States is obligated to deliver this power to Canada.

The Bonneville Power Administrator and the North Pacific Division Engineer are designated by Presidential Executive Order as the United States Entity. The British Columbia Hydro and Power Authority acts as the Canadian Entity. Both have established operating and hydrometeorological committees to develop and implement operating plans for Canadian storage and to collect real-time hydromet data needed to operate the system.

Northwest Power Planning Council

In December 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act which established the Northwest Power Planning Council. The Council is composed of two members each from Idaho, Montana, Oregon, and Washington; appointed by governors; and charged with preparing and adopting a regional conservation and electric power plan. The Council's charter also puts fish and wildlife considerations on an equitable basis with power planning and other purposes for which hydroelectric facilities were developed.

In December 1994, the Council passed amendments to its Fish and Wildlife Plan which called upon the region to implement certain actions for Columbia and Snake River salmon. The amendments, called the *Strategy for Salmon*, laid out a number of actions for the Corps, including operational changes to the hydro system and physical changes to the dams. Many of these actions also appeared in a Biological Opinion issued in March 1995 by the NMFS under the Endangered Species Act (ESA) concerning listed Snake River salmon species. The Corps, while attempting to respond to Council plans, has a legal mandate to fulfill ESA

requirements and has placed higher priority on the measures contained in the Biological Opinion.

Anadromous Fish

The Columbia River Basin provides habitat for five species of anadromous salmon and for steelhead. Anadromous fish hatch in fresh water rivers and tributaries, migrate to and mature in the ocean, and return to their place of origin as adults to spawn. Salmon generally live 2 to 3 years in the ocean before returning to spawning areas.

A number of factors have contributed to the current depressed state of salmon stocks in the Columbia and Snake River basins. Adverse effects of dams, logging, mining, cattle grazing, and pollution on spawning and rearing habitat; increased competition for food and the spread of disease from hatchery stocks; dams that impede the migration of salmon from their upriver rearing areas to the ocean and as they return as adults to spawn; over harvesting — historically in the 1800's and since then by incidental ocean take and sport and commercial fishery in the Basin; poor ocean conditions which have also brought coastal salmon and steelhead stocks to similar levels of decline; all of these have combined to lessen survival chances of the wild salmon stocks.

Despite regional efforts to stop declines in numbers of salmon and steelhead in the Columbia/Snake River Basin, three species of salmon have been listed under the ESA. Effective December 20, 1991, the NMFS listed Snake River sockeye salmon as endangered; effective May 22, 1992, Snake River spring/summer and fall chinook salmon were listed as threatened species. In August 1994, in an emergency action, NMFS changed the status of the two listed chinook salmon species to endangered.

The Corps' eight hydroelectric dams on the lower Columbia and Snake Rivers are widely believed to be a major factor in the decline in the numbers of wild Snake River salmon stocks. Besides physically impeding fish migration, the dams create reservoirs that alter water velocities and temperatures, interfering with juvenile migration patterns and improving conditions for predators.

Adult fish ladders have been built into each of the eight lower Snake and Columbia River dams. These allow adult fish to follow a series of graduated steps and pools to scale the 100-foot-rise in elevation from the tailrace to the forebay of the dams. The ladders have proved effective.

In the years since the dams have been in operation, many improvements have been made to juvenile fish passage routes at the dams. There are a number of ways for juvenile fish to pass the dams: over the spillways,

through the juvenile bypass systems, in specially designed barges, and through the turbines.

Activities for Salmon

Under the Endangered Species Act, the Corps prepares a biological assessment of the effects on listed species of planned operation of the Federal Columbia River power system. Following consultations between NMFS and the Corps, NMFS issues a Biological Opinion.

In its March 2, 1995, Biological Opinion for 1995 and future years, NMFS found that the planned operation of the Federal Columbia River power system would jeopardize the continued existence of the three listed Snake River salmon species. Accordingly, the Biological Opinion provided reasonable and prudent alternative measures to avoid jeopardy.

On March 10, 1995, Major General Ernest J. Harrell, Division Engineer for the North Pacific Division (retired in July 1995), signed a record of decision documenting the Corps' intent to implement the measures in the Biological Opinion.

The Biological Opinion calls for a variety of actions and studies for improving conditions for salmon migration throughout the Columbia and Snake River system. During the 1995 operating year, the Corps implemented operational measures such as flow augmentation, spills, juvenile fish transport, and lowered reservoir levels, as contained in the Biological Opinion. A technical management team of representatives from five federal agencies (the U.S. Fish and Wildlife Service, NMFS, Bureau of Fisheries, Bonneville Power Administration and the Corps) monitored river and fish conditions and recommended adjustments to operations during the migration season.

In accordance with the Biological Opinion, extended submerged screens are being installed in the existing juvenile bypass systems at Lower Granite and Little Goose Dams on the lower Snake River to increase the percentage of juvenile fish guided away from the turbine intakes and up through the bypass channels. These are expected to be in place in time for the 1996 juvenile fish migration season. Extended screen installation is planned for McNary Dam by 1997 and at John Day Dam by 1999 (both are on the lower Columbia River).

Construction of a conventional juvenile bypass system at Ice Harbor Dam on the lower Snake River is scheduled to be completed in 1996. The Biological Opinion calls for more juvenile fish barges to be constructed and enlarged exits to be installed on existing barges. Passive Integrated Transponder (PIT) tag monitoring facilities are

planned for installation at John Day Dam in 1997 and at Bonneville Dam by 1999.

For the long term, the NMFS Biological Opinion calls for evaluation and implementation of further improvements to the existing fish bypass systems, as well as a study of alternative structural configurations at the dams such as reservoir drawdowns and surface bypass systems. The Corps is evaluating natural river and spillway crest level drawdowns of the four lower Snake River reservoirs—Lower Granite, Little Goose, Lower Monumental, and Ice Harbor. The idea behind drawdowns is to increase the velocity of the river by decreasing the cross-sectional size of the reservoirs.

Drawdown of the John Day pool to minimum operating level during the juvenile fish migration season and the study of a spill crest level drawdown at John Day are also requested in the Biological Opinion.

Surface bypass is a relatively new technology that holds promise of more efficiently and effectively bypassing juvenile fish at the dams. Surface bypass systems would intercept the fish within the upper portion of the water column where they normally migrate. There is a potential for reduced spill with these systems. In 1995, the Corps installed and tested several types of guidance systems for surface bypass at Ice Harbor and The Dalles Dams. Installation of a prototype surface collector is planned at Lower Granite Dam for 1996.

Other studies focus on improved gas abatement during spill; refined turbine design to reduce turbulence and negative pressures; and light and sound generation, as well as physical barriers, to guide fish.

Research efforts are continuing concurrently, including evaluation of in-river migration versus transport of juvenile fish, study of juvenile fish survival and travel time through the reservoirs, and various aspects of fish behavior.

Long-Term Studies

The Corps completed Phase I of its System Configuration Study (SCS). This study evaluated alternative physical and structural modifications that could be made to the lower Columbia and Snake River projects to improve anadromous fish passage. Several structural and operational modifications will be implemented and evaluated further on the lower Snake River dams under SCS Phase II. These modifications, with implementation timelines, have been incorporated into NMFS' Biological Opinion. This document addresses specific criteria in regard to the operation of the Federal Columbia River Power System since the listing of Snake River sockeye, spring/summer chinook, and fall chinook salmon as endangered under the ESA.

Measures to be implemented include the following: enlarge juvenile transport barge exits on existing barges by 1997; acquire additional transport barges to provide direct-loading capability from all transport facilities (maximum of nine barges by 2001); overhaul the Lower Granite juvenile fish facility by 1998; installation of picketed lead fences in adult channel entrances to reduce fallout rate; and fish ladder temperature control mechanisms.

The other major portion of SCS Phase II is the Lower Snake River Juvenile Migration Feasibility Study. This is a multifaceted study that will evaluate the merits of drawing down the lower Snake River reservoirs and the utilization of new surface collection technology. Many believe that attempting to return the river to a more natural condition by increasing flows during the juvenile outmigration time period will significantly increase juvenile survival and hence recovery of the listed species. Preliminary biological benefit and economic cost information will be assembled this year and presented to NMFS and the region to assist in determining which, if any, specific drawdown option to pursue with detailed engineering and design. Construction would possibly begin in 2001. Ongoing and new research will be conducted to address key uncertainties associated with in-river and reservoir mortality, predation, and transport benefits and impacts, such as delayed mortality and homing impacts on returning adults.

A prototype surface collector will be installed on Lower Granite Dam for the spring 1996 juvenile fish outmigration. This new concept and structure, the design of which has been adapted from similar structures utilized on some of the mid-Columbia dams, holds promise for increasing the efficiency of intercepting juvenile fish prior to their entering the dam's turbine intakes. Continued testing of structures will occur on the lower Snake, mid-Columbia, and lower Columbia dams through at least 1999.

The final feasibility report, which will be issued in 1999, will present a comprehensive analysis of surface collection and drawdown, as compared to the methods currently utilized (with improvements that will have been implemented by that time) to aid in moving juvenile salmon downstream. The report will recommend implementing the action, or combination of actions, showing the greatest potential benefit to the ESA-listed species, in consideration of overall biological and economic benefits, costs, and impacts.

Pacific Salmon Coordination Office

To increase the Corps' responsiveness to salmon issues in the region, a Pacific Salmon Coordination Office was established in North Pacific Division in November 1994.

The Salmon Office focuses on internal coordination on salmon issues, as well as improved communication and coordination with regional state and Federal agencies, tribes, organizations, and the general public.

The office provides oversight and strategic planning of Corps' activities to ensure timely completion of actions and studies for salmon restoration.

Anadromous Fish Evaluation Program (AFEP)

The Corps recently restructured its research program, formerly the Fish Passage Development and Evaluation Program, to assure that salmon studies are fully coordinated internally and with regional entities and programs. These include the Pacific Salmon Coordinating Committee (a regional Federal agency team), NMFS Biological Opinion, Northwest Power Planning Council's Fish and Wildlife Program, States, and tribes. Research focuses on improved fish passage and survival through the dams and reservoirs.

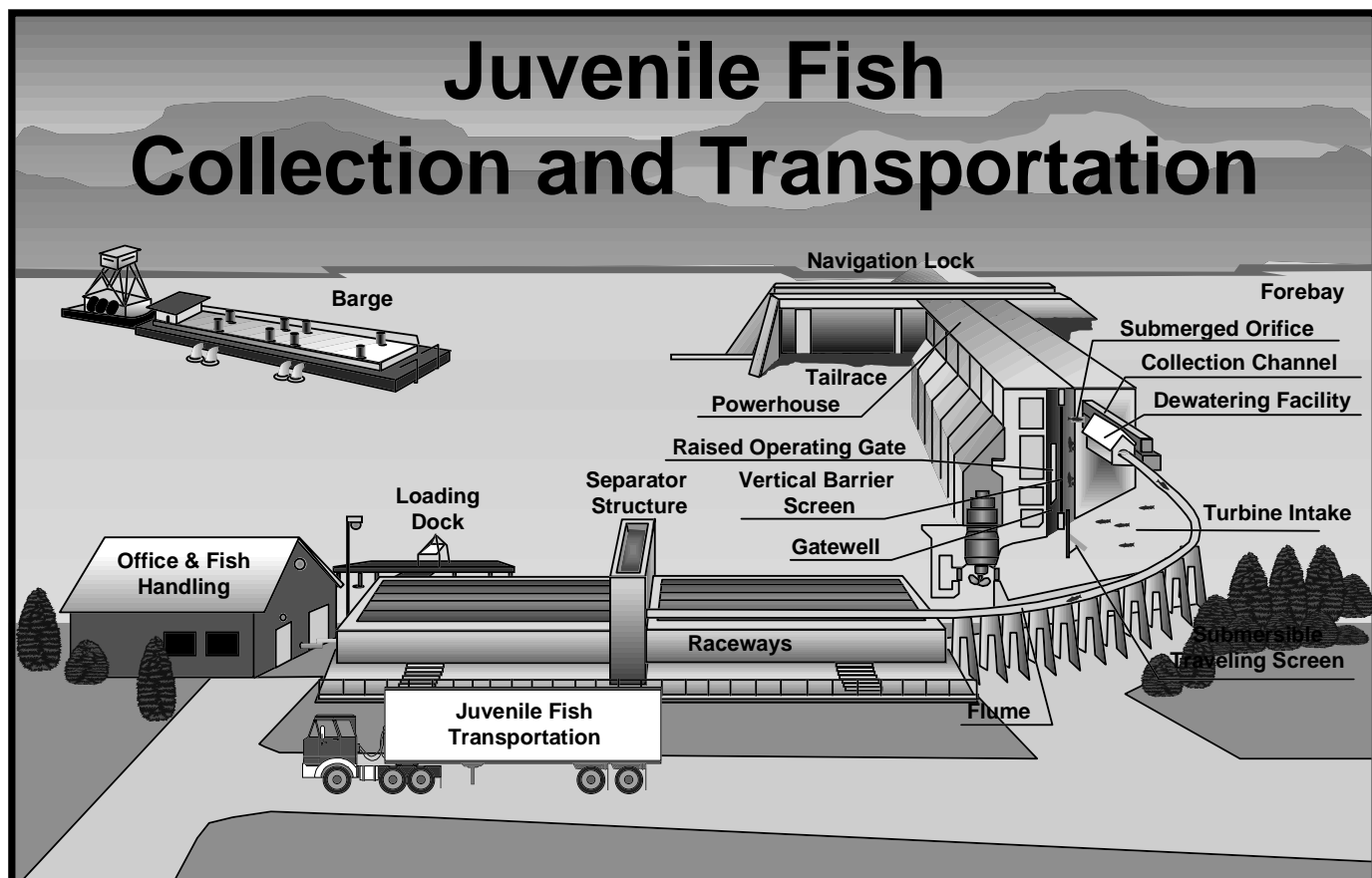
Under the new structure, a Corps AFEP Coordination Team oversees the program and provides command and

control, program management, quality assurance, and regional interface for all anadromous fish evaluations.

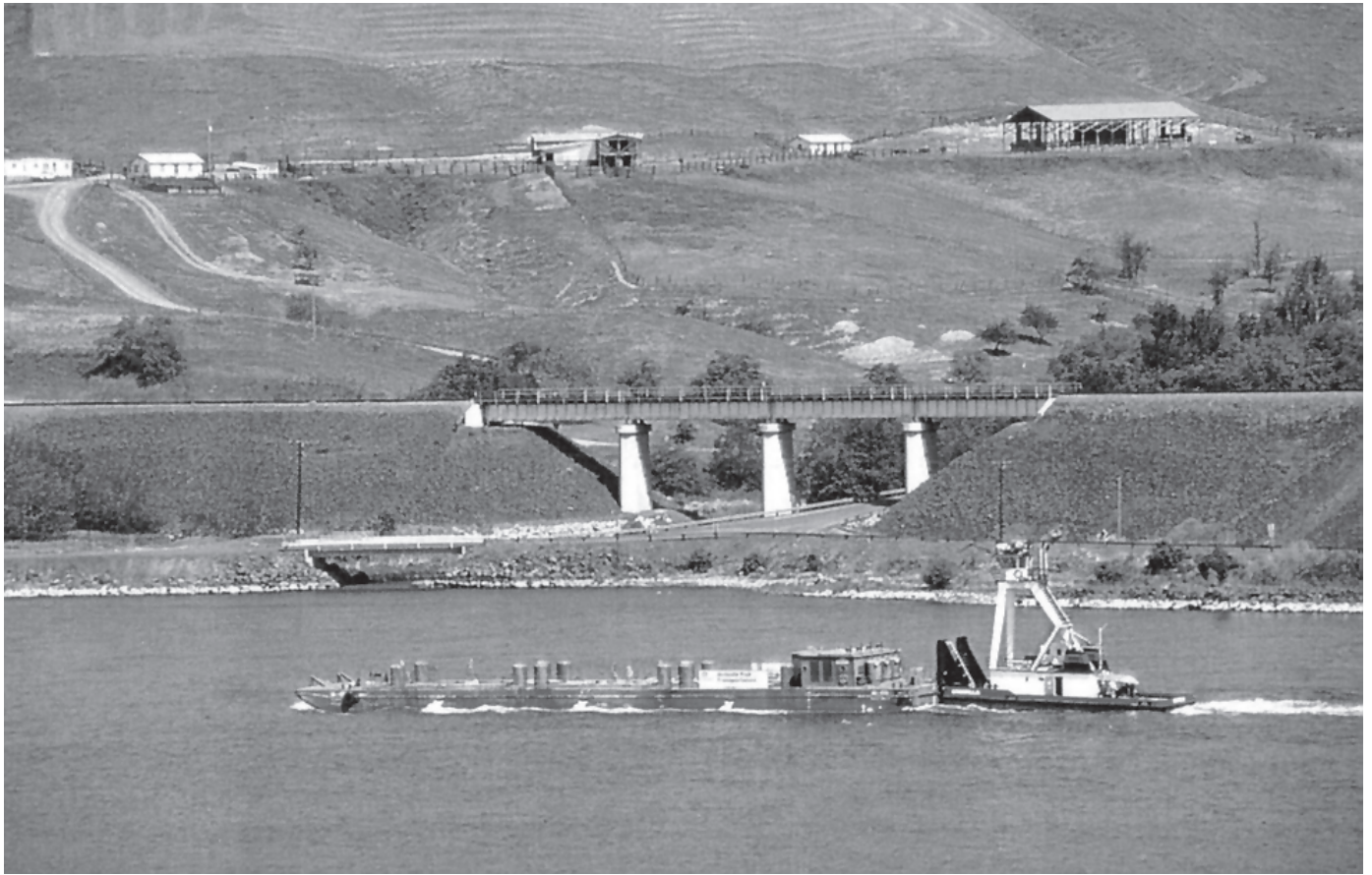
A Technical Coordination Team provides a process for interfacing with Federal and State fishery agencies, tribes, and other interested parties to assure that they have adequate opportunity for review and to provide recommendations throughout the development and implementation of AFEP studies. The team will also coordinate scientific peer review of AFEP proposals, test fish needs, and study results.

Publication Available

Because of regional interest in actions to aid the migration of salmon and steelhead past the dams operated by the Corps, a publication, *Salmon Passage Notes*, is published several times a year. Individuals who wish to be on the mailing list should write to Editor, *Salmon Passage Notes*, North Pacific Division, U.S. Army Corps of Engineers, Box 2870, Portland, OR 97208-2870. A limited number of back issues are available.



Juvenile Fish Collection and Transportation



Fish Barge

Major River Basins



Snake River, Twin Falls

CHAPTER FOUR

Major River Basins

Idaho is a mountainous state with elevation extremes. The highest point in the state is Mount Borah at 12,655 feet in the Lost River Range. In the Clearwater Valley near Lewiston, the lowest elevation is 728 feet. There are 22 mountain ranges in Idaho. Most important are the Bitterroot, Lost River, Owyhee, Beaverhead, Lemhi, Clearwater, Centennial, and Caribou ranges. Hells Canyon, formed by the Snake River cutting through the Seven Devils Range between Idaho and Oregon, is the deepest and narrowest major gorge on the North American continent. The canyon is more than 8,000 feet deep. The Clearwater Mountains form the largest concentrated mountain range, extending 125 miles from the St. Joe River south to the Salmon River. The 14,000-square-mile Snake River plain, part of the Columbia plateau, extends in a crescent across southern Idaho from east to west. Most of the State's land mass slopes to the west from the high, central wilderness mountains and Continental Divide in the East.

The predominant river in Idaho is the Snake River, rising in Yellowstone National Park and flowing for 1,000 miles in an arc-like course through southern Idaho. Important tributaries are the Boise, Clearwater, Salmon, Payette, Owyhee, Weiser, Big Wood, and Bruneau Rivers. The southeast portion of the State features the Bear River, which flows south into the Great Salt Lake. The Kootenai and Clark Fork Rivers in the north flow into the Columbia River. Associated with the Snake River in its course through southern Idaho is the Snake River Aquifer, one of the largest in the world.

Idaho has more than 2,000 lakes. Coeur d'Alene, Pend Oreille, and Priest Lakes in the north are the largest. Jackson Lake on the Snake River in Wyoming was constructed primarily to provide irrigation water for Idaho. The State's largest man-made reservoir is impounded by Dworshak Dam on the North Fork of the Clearwater River. Dworshak Reservoir is 53 miles long, has a surface area of 17,090 acres, and stores 3,468,000 acre-feet of water when full.

Idaho's relatively high average temperature, about 46 degrees Fahrenheit, is due to the nearness of the Pacific Ocean, warm Chinook winds from the Columbia Valley, and the Rocky Mountains blocking cold northeast winds from Canada. Precipitation levels vary because of the topography. In the mountainous reaches of

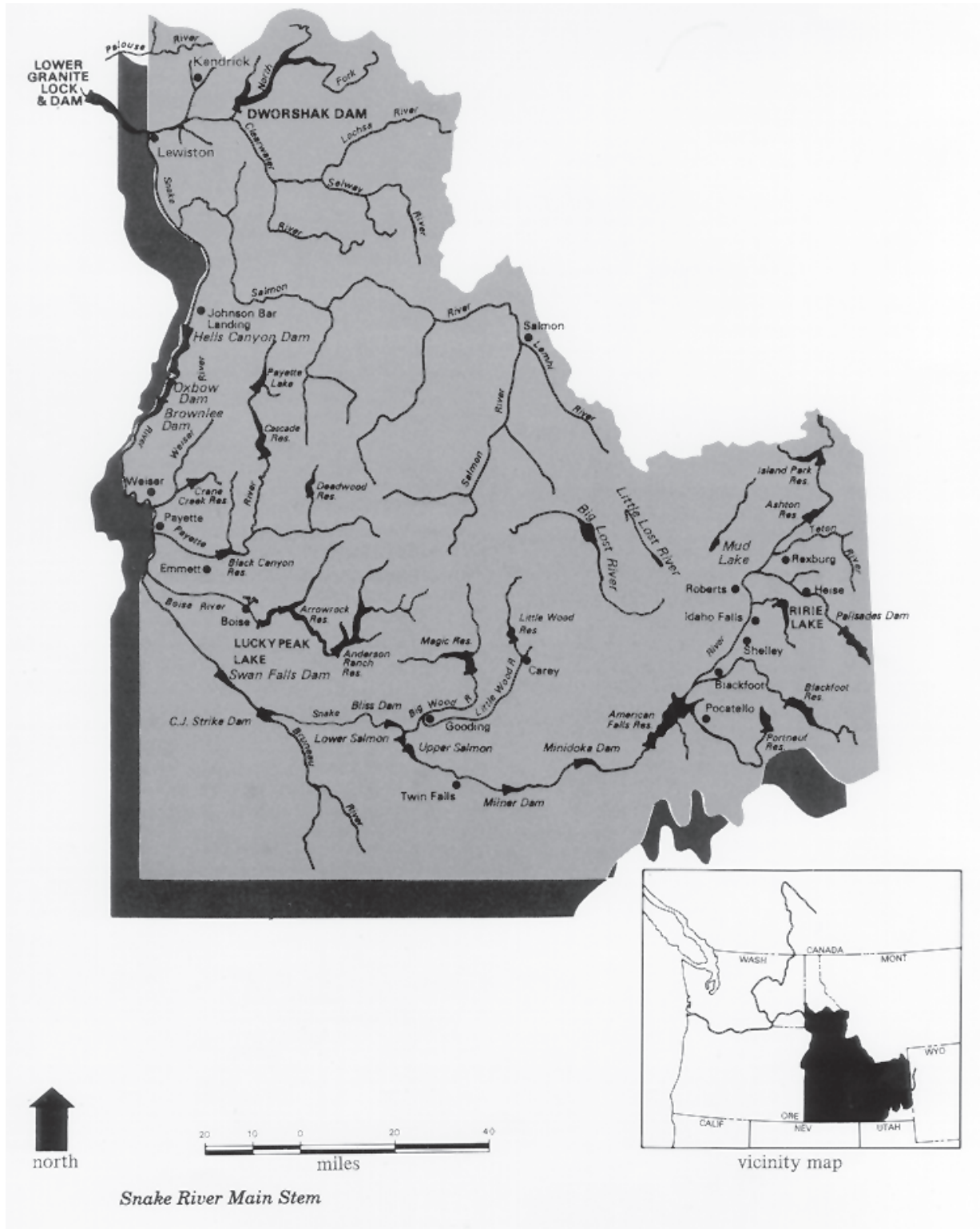
the Clearwater, Payette, Boise, Salmon, and Priest River basins, 40 to 50 inches of water from rain and snow fall annually. In the arid plains of southern Idaho, less than 10 inches of precipitation is recorded annually.

Idaho has been dependent upon mining, lumbering and irrigation farming for years. The State produces more than one-third of all silver mined in the United States. World War II military requirements accelerated the State's growth with development of the food processing industry. Crops include potatoes, wheat, apples, corn, barley, and hops. Manufacturing is steadily increasing.

With winter sports becoming more popular in the nation, tourism has become a major economic resource for Idaho. Tourism now outranks mining in dollar revenue. Streams, lakes, mountains, and forests provide fishing, camping, hunting, and boating sites. The nation's largest elk herds draw hunters from all over the world. Sun Valley attracts thousands of visitors each year to its swimming and skiing facilities.

The Snake River Basin holds most of the State's population, reaffirming the importance of rivers to population distribution. The 21 counties bordering the river hold 74 percent of the 1.5 million total population of Idaho. Land area of Idaho is 52,910,000 acres, generally equaling that of Great Britain. More than half of the land is owned by the Federal Government.

Snake River Main Stem



CHAPTER FIVE

Snake River Main Stem

The Columbia-Snake Inland Waterway

Discovered by Captain Robert Gray in 1792, the Columbia River has been a commercial waterway since the early 19th century. Fur traders of the Northwest Company, Astoria Pacific Fur Company, and the Hudson's Bay Company used it regularly. Ocean going vessels penetrated to Vancouver, Washington, and also to Portland and Oregon City, Oregon, via a tributary, the Willamette River. By the mid-19th century, river steamers were plying sections of the Columbia upstream from Vancouver, but rapids blocked commerce into the interior.

Wagon portages were used at first, then railways, until the Cascade Canal and Locks were constructed in 1896 by the Corps. The old canal is now under the waters of the lake backed up by Bonneville Dam. The Dalles-Celilo Canal, constructed in 1915, also is under water, flooded when The Dalles Dam was completed. When gold was discovered in Idaho in

1862, steamers began traveling from The Dalles, Oregon, on the Columbia River to Lewiston, Idaho, on the Snake River. They occasionally made trips beyond Lewiston on the Clearwater River to the Orofino mines. Before construction of Grand Coulee Dam, the upper Columbia was navigable in some seasons to Kettle Falls, 700 miles above the mouth of the river.

The Columbia-Snake Inland Waterway now extends from the Pacific Ocean to Lewiston, Idaho, a distance of 465 miles. After traveling about 145 miles upstream from the mouth of the Columbia River, barges encounter Bonneville Lock and Dam. From this point, the barges are lifted about 340 feet by the four Columbia River locks at Bonneville, The Dalles, John Day, and McNary Dams and about 398 feet by the four Snake River locks, a total lift of 738 feet.

Bonneville Dam was the first of the multipurpose projects authorized by Congress for construction by the Corps on the lower Columbia River. It was the first of a series of eight locks and dams constructed between the Portland-Vancouver area and Lewiston. Barge navigation on the Snake River to



Lower Granite Lock and Dam

Lewiston became a reality when a series of four dams with locks, originally authorized by Congress in 1945, were completed in 1975. The four are Ice Harbor, Lower Monumental, Little Goose and Lower Granite. Lower Granite, the farthest upstream and about 30 miles downstream from Lewiston, started operation in 1975. When the reservoir filled, a new, deepened, calm-water channel was formed and Idaho was linked with the sea.

Shallow-draft, fast-water conditions continue for commercial navigation on the Snake River above Lewiston to Johnson Bar Landing in Hells Canyon.

Hells Canyon, Oxbow, and Brownlee Dams

Hells Canyon, Oxbow, and Brownlee Dams were constructed and are operated under a common Federal Power Act license by the Idaho Power Company. Hells Canyon Dam is upstream of Johnson Bar at River Mile 247. Oxbow Dam is at River Mile 273 and Brownlee Dam is at River Mile 285, just downstream of the Powder River confluence. The three-dam complex is operated as a system primarily for power production. Installed generating capacity is 941,900 kilowatts.

Brownlee Dam is a 400-foot-high rockfill structure with a total reservoir capacity at full pool of 1,420,062 acre-feet. The reservoir capacity is sufficient to provide for multiple project uses, including hydropower, flood control, navigation, recreation, and fisheries mitigation. Installed power generating capacity is 360,400 kilowatts.

Oxbow Dam is a 205-foot-high rockfill structure and Hells Canyon Dam is a concrete, gravity structure with a maximum structural height of 320 feet. Installed power-generating capacity at Oxbow Dam is 190,000 kilowatts, and the capacity at Hells Canyon Dam is 391,500 kilowatts. Both Oxbow and Hells Canyon Dams have minimal active storage capacity and serve primarily to re-regulate power releases from upstream generating capacities. Brownlee Dam was completed in 1959, Oxbow Dam was completed in 1961, and Hells Canyon Dam was completed in 1968.

The terms of the common Federal Power Act license include provisions for downstream flood control and navigation. Operating regulations for flood control and navigation were established by the Walla Walla District and incorporated into a water control manual for the Idaho Power Company projects.

During spring runoff, up to 975,318 acre-feet of active storage space is made available in Brownlee Reservoir for flood control regulation on the lower Snake and Columbia Rivers. Flood control regulation is coordinated with the Corps Reservoir Control Center in Portland.

The navigation provisions in the license agreements specify the minimum flows that must be maintained in the Snake River reach below Johnson Bar. The minimum flows benefit mail and freight deliveries above Asotin, Washington,

and recreational users in the Hells Canyon reach of the Snake River.

Idaho Power Company is a member of the Northwest Power Pool, and the company also has made agreements with the Bonneville Power Administration to provide special releases benefiting the Water Budget Fishery Mitigation Program at Lower Granite Dam. Releases for Water Budget purposes are coordinated with releases from Dworshak Dam and Reservoir.

Lower Granite Lock and Dam, Lower Granite Lake

Lower Granite Lock and Dam, is the farthest upstream of the four locks and dams on the lower Snake River below Lewiston, Idaho.

The project was authorized by Congress in 1945 for navigation and power generation. Other project authorized purposes include recreation, irrigation, and fish and wildlife. The dam is 32 miles west of Lewiston and 107.5 miles upstream from the confluence of the Snake and Columbia Rivers.

Construction started in 1965, and the lock and dam became operational 10 years later. All general construction at the dam itself, at the recreation sites, and along the Lewiston levee system was completed in 1984.

The dam has a structural height of 254 feet and a hydraulic height of 100 feet from normal tailwater to normal high pool. Its total crest length is 3,200 feet. The combined structure consists of a single-lift navigation lock, spillway, powerhouse, non-overflow sections, and adult and juvenile fish facilities. Power from the first of three 135,000-kilowatt, turbine-driven generators went on-line in April 1975. Installation of three additional units of equal capacity was completed in 1978, bringing the total power plant capacity to 810,000 kilowatts.

The reservoir facilities provide commercial navigation to Clarkston and Asotin, Washington, and Lewiston, Idaho. Under power-generating conditions, the reservoir surface level varies between 733 and 738 feet mean sea level at the confluence of the Snake and Clearwater Rivers at Lewiston-Clarkston.

Lower Granite Lake extends 39 miles up the Snake River from Lower Granite Dam to Asotin, Washington, and 4.6 miles up the Clearwater River from its confluence with the Snake River at Lewiston. Much of the lake is in a deep gorge bounded by steep, rocky slopes rising up to 1,700 feet above the surface. At full pool, the lake has a surface area of 8,900 acres and an average width of 2,000 feet.

Lower Granite Dam is considered a run-of-the-river dam, and only enough active storage capacity is

included in the lake design to provide ponding to support daily power peaking operations. The normal authorized operating range is between elevations 733 and 738 feet mean sea level at the confluence of the Snake and Clearwater Rivers.

Lower Granite Lake was filled in February 1975, and the navigation lock went into operation in June of the same year. The lake provides a minimum 14-foot-deep commercial navigation channel to the ports of Wilma and Clarkston in the State of Washington and the Port of Lewiston in the State of Idaho.

Commerce through the Lower Granite navigation lock totaled 2,414,283 tons through calendar year 1995. Project construction costs through September 1995 totaled \$374,836,315, and operation and maintenance costs were \$110,328,532. The total national economic benefit for visitor spending at Lower Granite Lake in 1994 was \$106,438,000.

Through September 1995, the project generated 51.39 billion kilowatts of electricity. Revenues from the sale of power by Bonneville Power Administration are returned to the U.S. Treasury to repay, with interest, construction costs as well as operation and maintenance costs of the project.

Approximately \$4,622,000 in potential damages have been prevented since the levees became functional.

Recreation

Nine miles of levees were constructed along the banks of the Snake and Clearwater rivers, encompassing essentially the entire length of the waterfront of Lewiston and north Lewiston. The design included a series of collector ponds and pumping plants for interior drainage. Subsequently, the Corps initiated extensive landscape architectural development of the levees as a national pilot project for levee beautification efforts. Levee beautification was intended as an integral feature of the Lewiston Levees. The work included sculpturing the topography; development of ponds and lawns; tree and shrub plantings; park furniture; interpretive displays; and paved trails. The area is now known as the Lewiston Levee Parkway.

A paved trail extending along the levees and adjacent portions of project lands in both Washington and Idaho was designated as the Clearwater and Snake River National Recreation Trail by the Secretary of the Interior in 1988. The 16-mile trail connects several recreational areas including the Lewiston Levee Parkway, Kiwanis Park, and Hells Gate State Park. It then crosses the Interstate Bridge and passes through Swallows Park, ending at the boat ramp area next to the Lower Granite-Little Goose resources office at Clarkston.

In addition to the Lewiston Levee Parkway, recreational opportunities can be found in the Idaho portion of the lake at Clearwater Park along the North Lewiston Levee, as well as several boat ramps, Hells Gate State Park and North Lewiston Community Park. Available amenities include day use, camping areas, and a marina. Additional recreational sites are in the Washington portion of the project.

In 1995, more than 861,500 people visited the project and lakeside recreation areas.

Fish and Wildlife

Public lands total about 9,000 acres. Of this total, about 200 acres have been classified as intensively managed wildlife areas. Habitat development is in progress at a number of sites to replace habitat inundated by the reservoir or destroyed by relocation of roads and railroads. Habitat developments on project lands in Idaho are at the Goose Pasture Habitat Management Unit along the Clearwater River and the Hells Gate Habitat Management Unit along the Snake River.

Major improvements include irrigation, tree and shrub plantings, nesting areas, and food plots. Wildlife habitat also is protected and maintained where possible throughout the rest of the public lands. Because of the steep and rugged slopes near the reservoir, only a relatively small land area above the lake level is available for recreational access or wildlife habitat development. (See discussion on management of wildlife lands under the Lower Snake River Fish and Wildlife Compensation Plan, Chapter 3.)

The annual salmon and steelhead runs up the Snake River and its tributaries are an important resource for the State of Idaho.

Lower Granite Dam includes facilities for both juvenile (downstream migration) and adult (upstream migration) fish passage. The adult fish passage facilities consist of an auxiliary water supply system and a series of entrances across the downstream face of the dam providing access to an interior channel leading to a fish ladder. The fish ladder provides a route over the dam to the upstream lake.

The juvenile fish passage facilities consist of submersible traveling screens upstream of each power intake which direct fish into a collection channel. The juveniles may then be routed into downstream collection facilities or bypassed directly into the river below the dam. At the collection facilities, the juveniles are distributed to either a tank truck or fish barge for transport below Bonneville Dam as part of the Corps Juvenile Fish Transportation Program. Juvenile spring chinook salmon and steelhead trout are sampled and tagged for research and monitoring. Modifications to the fish passage facilities are made almost yearly in order to improve bypass efficiency.

A significant improvement to collection efficiency was accomplished in 1989 by raising the emergency head gates in the A and B slots of all units. A permanent gate-raise condition was completed in 1992. Extended-length screens will further improve guidance with installation scheduled for 1996.

Improved anadromous fish runs are due, in part, to improved fish bypass facilities at the dams, new hatchery construction, and the Corps' Juvenile Fish Transportation Program. In 1982, about 1,942,000 juvenile fish were collected at Lower Granite Dam. Of this number, 1,852,000 were transported downstream. In 1995, collection had swelled to 9,733,497 migrants with almost all fish, 9,051,299, transported. In 1994, 5,077 spring chinook (spring/summer) salmon and 47,550 steelhead trout returned to upstream spawning grounds or their hatcheries of origin via a project fish ladder.

Sediment accumulation in Lower Granite Lake has and continues to reduce the designed capability of the Lewiston Levee system for flood protection and impact authorized navigation. Interim dredging has stabilized the flood protection problem since 1986, but a long-term solution is needed.

Sedimentation was considered during the Lewiston Levee design, but a decision on a long-term solution was delayed for lack of data until after levee construction. Preliminary studies completed in 1984 led to interim dredging and to detailed studies to identify a long-term plan. Dredging was done for interim flood control in

1986, 1988, 1989, and 1992 and for navigation from 1982-84 and in 1987.

The proposed feasibility study will seek the least cost, most environmentally sound method of regaining and maintaining adequate flood protection and navigation for the future. Alternatives include dredging (with on-land or in-water disposal), levee modifications, instream structures, land treatment, and reservoir operation changes.

Due to the sensitive nature of the aquatic environment in Lower Granite Lake, an advisory interagency working group was formed. The resulting agency concurrence with in-water placement of sediment on a test basis in lieu of upland disposal was a significant advance. A multi-year prototype, in-water placement of sediment with environmental monitoring is the key element of this study. Three sites were developed and monitored: an upland bench, an exposed island, and a deep-water site. It is hoped these tests will lead to agency acceptance of in-water placement as a long-term solution. Agencies are primarily concerned about the effect of relocating sediments on anadromous fish. The final and most important phase of the prototype test involving deep-water placement was postponed in 1990 and 1991 due to lack of funds for interim dredging. The third year of the disposal test was completed in 1992. The 1992 dredging event placed the last sediments in-water for biological testing. Biological monitoring has continued annually since 1986 and was completed in 1994.



Lewiston Bridge and Levees

A draft report has been received from the University of Idaho on the biological impacts of in-water disposal of sediments. The final report is pending.

The final phase of the feasibility study is projected to restart in fiscal year 1997 and is anticipated to extend over a three-year period. The study will evaluate alternatives including raising the existing levees to various heights, in combination with dredging, using both in-water and on-land disposal methods. The draft feasibility report and environmental impact statement are tentatively scheduled for completion in fiscal year 1999.

Lewiston-Clarkston Bridge

Lower Granite Lock and Dam backed up water to the Lewiston-Clarkston area, providing slackwater navigation and increased commercial traffic in that area of the Snake River. With increased navigation, greater use of the lift span on the existing bridge over the Snake River between the two cities caused frequent interruptions to heavy vehicle traffic and vital intercity medical, police, and fire services.

A new high-level bridge upstream of the existing bridge was authorized in the Water Resources Development Act of 1976. The bridge was essentially completed and opened to traffic in 1984. Federal construction costs on the project through September 1988 were \$21,660,832.

Walla Walla District and the contractor, T. Y. Linn International, received a national "Excellence in Highway Design" award in 1987 from the Federal Highway Administration for design and construction of the bridge.

Navigation - Lewiston to Johnson Bar Landing

Congress authorized work by the Corps on the 92-mile reach of the Snake River between Lewiston and Johnson Bar Landing in 1902 and again in 1910 and 1935. Boulders and other obstructions were removed from the channel. In 1949, a wing dam was constructed from the bank into the stream to provide greater depth over Temperance Creek Rapids, about 8 miles downstream from Johnson Bar.

The 92-mile reach of the Snake River from Lewiston upstream to the Johnson Bar Landing is the primary means of access for many Hells Canyon residents. Commercial jet boats operating on the waterway regularly provide mail service and cargo transport. In addition, numerous operators offer recreational white water excursions.

Pleasure boating, fishing, and rafting are important uses by private individuals. In 1995, boaters spent more than 52,723 recreation days on the river.

The Snake River provides access and mail service to canyon residents. River launches transport animal feed, household goods, and groceries upstream and wool and other miscellaneous cargo downstream. Nearly 4,000 persons are transported annually into the canyon reach on sight-seeing expeditions.

The Hells Canyon reach of the Snake River is considered navigable under terms of the Rivers and Harbors Act of 1899. Beginning in 1902, the Corps undertook projects to improve the waterway. These ranged from removal of various obstructions in the navigation channel to installation of navigation markers along the canyon walls.

Construction on the upstream Idaho Power Company hydropower projects, Hells Canyon Dam, Oxbow Dam, and Brownlee Dam was completed in 1968. The Federal Energy Regulatory Commission (since replaced by the Federal Power Commission) licenses for the Idaho Power Company projects specify minimum releases from Hells Canyon Dam to maintain navigation in the downstream waterway. The licenses also specify a maximum rate of change in the releases.

Terms of the licenses regarding navigation and flood control are administered by the Corps. The Corps has granted exceptions to the minimum release restrictions in extremely low-flow years such as 1988, but agreements were reached with Idaho Power to configure remaining releases to minimize the impact on mail service and private and commercial boating interests. In a review of Federal Energy Regulatory Commission licenses, the Federal Power Commission decided not to make any changes in the minimum release requirements.

Blackfoot Area Levees

The project provides bank protection at a critical location along the left bank of the Snake River about 7 miles southwest of Blackfoot, Idaho. The project prevents a potential breakthrough of the Snake River across irrigated farmlands into the Blackfoot River. The work was completed in 1958 at a Federal cost of \$43,000. Through 1995, the Blackfoot Area Levees on the Snake River have prevented \$53,196,000 in flood damages since construction.

Shelley Area Revetment

Improvements consist of bank sloping reinforced with dumped stone revetments along the left bank of the Snake River about 4 miles downstream from Shelley. The project provides protection for the Firth, Idaho, reach against a breakthrough by the Snake River into a feeder canal of the Blackfoot Irrigation District. It also prevents damage to the

canal and surrounding agricultural areas. Through 1995, the revetment has prevented \$5,168,000 in flood damages.

Heise Area Levees

The completed project consists of channel clearing, alignment changes, levee construction, and bank protection along a 22-mile reach of the Snake River between Heise and the mouth of Henrys Fork in eastern Idaho. The levees will contain river discharges of up to 33,000 cubic feet per second and prevent flooding and erosion damage primarily on irrigated farmland.

The project was completed in 1954 at a Federal cost of \$1,576,000. Since then, \$9,539,000 in flood damages have been prevented through 1995.

Heise-Roberts Levee Extension

This project provides protection along the Snake River between Henrys Fork and Roberts, Idaho, and was an extension of the upstream flood control work. Improvements include channel clearing, rectification, levees, and bank protection.

The project provides protection against flood damage to lands used for row crops and general irrigated farming.

The project was completed in 1968, at a Federal cost of \$3,403,000. Since completion, flood damages amounting to \$16,782,000 have been prevented through 1995.

Jackson-Palisades Project

Two upstream reservoir projects operated by the Bureau of Reclamation are regulated as a system during the spring runoff period to provide additional flood protection to the Heise area. Palisades Dam is a 270-foot-high, compacted earthfill structure on the Snake River 7 miles upstream from the town of Irwin. It was completed in 1957 with an active reservoir capacity of 1.2 million acre-feet. The length of the dam is 2,100 feet.

Jackson Dam, in Wyoming, is a 70-foot-high concrete gravity dam with earth embankment wings. It was constructed in stages, beginning in 1907. The current active reservoir capacity of 847,000 acre-feet was reached with additions to the dam in 1919. Restrictions on the use of the active capacity of the reservoir were imposed in 1978 due to concerns over the seismic stability of the earthfill embankment. The restrictions were removed in 1988, following the completion of major improvements to both the earthfill embankment and the concrete spillway section.

Flood control regulations of the Jackson-Palisades system are stipulated under provisions of Section 7 of the Flood Control Act of 1944. Flood control regulation is

coordinated with the Corps of Engineers, and the operation policies are incorporated into the Water Control Manual for the two projects. Storage space of up to 1.4 million acre-feet in Palisades Reservoir and Jackson Lake is made available on a forecast basis during the spring runoff for flood control downstream to American Falls Reservoir.

Releases at the two projects are scheduled to evacuate and refill reservoir space without exceeding 20,000 cubic feet per second at the Heise gauging station, as far as practicable. Extraordinarily large floods are regulated with the intent of not exceeding 30,000 cubic feet per second at the Heise gauge.

At other times of the year, the Jackson and Palisades projects are operated primarily to provide irrigation water to Idaho. Palisades Dam also has a power generation plant with installed capacity of 114,000 kilowatts. The power plant underwent modifications in 1990 to further increase its capacity. Power generation is incidental to both flood control regulation and irrigation releases.

Before construction of Palisades Dam, discharges from Jackson Lake were reduced to zero during autumn and winter to conserve water supplies for irrigation. During the spring, sustained high releases aggravated bank erosion problems. The coordinated operation of the two projects now results in a much smoother release pattern, eliminating most of the previous problems. Minimum streamflows are scheduled from both projects to benefit recreation such as rafting and fish and wildlife, while continuing to meet irrigation contracts and municipal flow rights at the Idaho Falls Hydroelectric Plant.

Jackson Lake is not operated to reduce flooding below the town of Heise. With Palisades Dam in place, the Bureau of Reclamation is able to meet irrigation and flood control requirements and maintain minimum streamflows to protect fish habitat and meet municipal flow rights at the Idaho Falls Hydroelectric Plant.

Fly-fishing float trips and recreational rafting have become popular on all reaches of the Snake River above Idaho Falls. Snowmobiling and ice fishing are popular winter sports on the lake and project lands behind Palisades Dam. Waterfowl nesting and hatching along the Snake River downstream of Palisades Dam also have been enhanced by stabilized river flows and riverine conditions.



Heise-Roberts

Palouse River Basin



CHAPTER SIX

Palouse River Basin

Basin Studies (Walla Walla District)

The Palouse River Basin Study was authorized in 1949 by resolutions of the House and Senate committees on Public Works. The study has been confined principally to the upper basin above Colfax, Washington.

The Palouse River originates in the mountains of northwestern Idaho and flows west and southwest to its confluence with the Snake River. It drains about 2,800 square miles of northwestern Idaho and eastern Washington. Flood damages come from snowmelt or heavy rains in the Potlatch and Moscow, Idaho, areas.

Previous comprehensive studies of the basin considered water quality control, flood control, irrigation, erosion and sediment control, municipal water supply, fish and wildlife enhancement, and recreation. Coordination was conducted with the U.S. Bureau of Reclamation, Environmental Protection Agency, Soil Conservation Service, Bureau of Outdoor Recreation, U.S. Forest Service, and fish and wildlife agencies.

The Pullman-Moscow Water Resources Committee was formed in 1966. It was started again in 1987 to investigate a source of supplemental municipal water supply. Currently, it monitors groundwater levels and usage and promotes water conservation and research.

Committee participants included the cities of Moscow and Pullman, Washington State University at Pullman, University of Idaho at Moscow, and the counties of Whitman and Latah. Past studies investigating municipal water supply alternatives indicated the possibility of multipurpose development on the North Fork of the Palouse River with transfer of water via a pipeline to the Pullman-Moscow area.

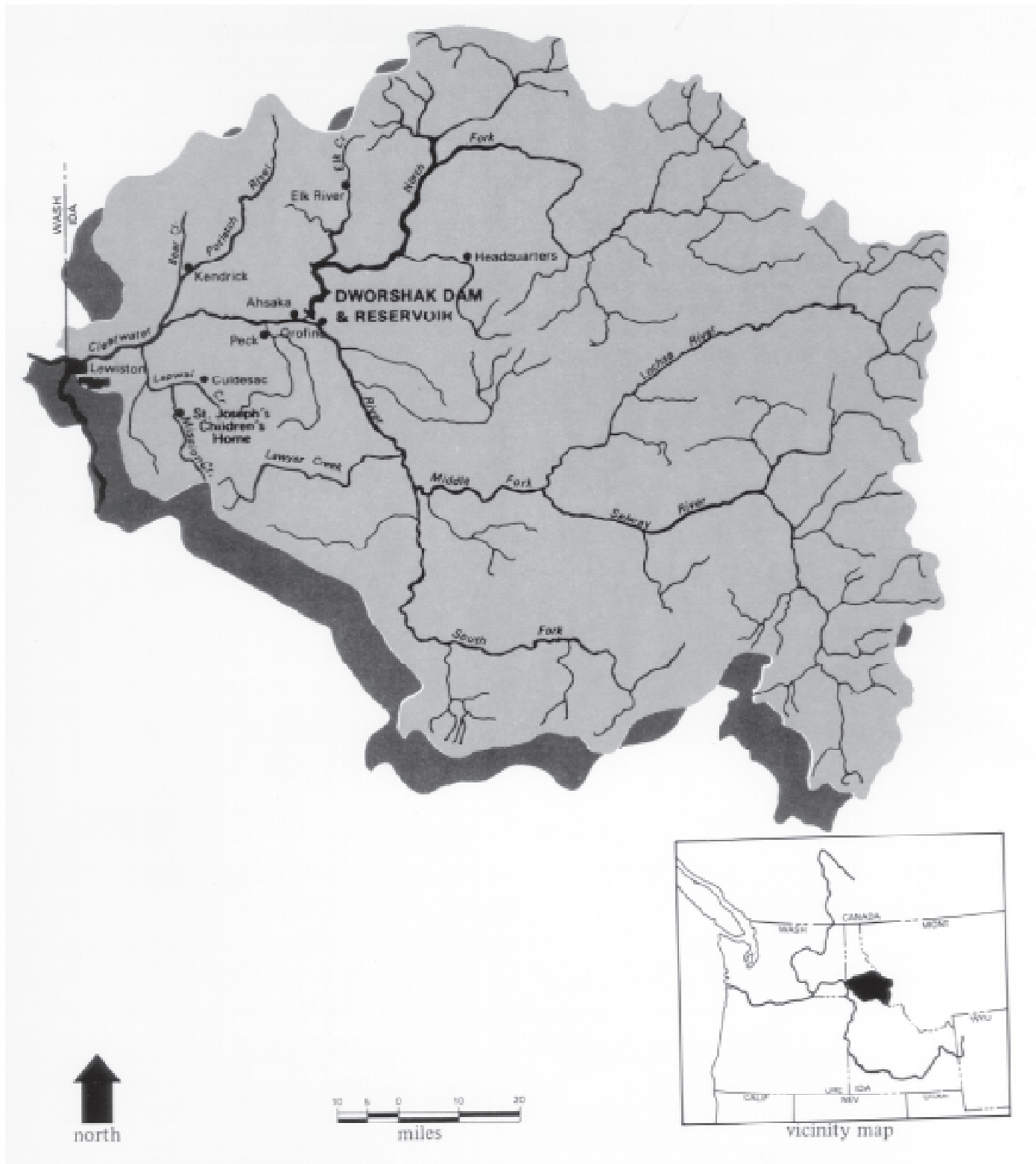
The Palouse River Basin Study was resumed in April 1988 with emphasis on flood protection and supplemental water supply needs in the Moscow-Pullman area. Benefits due to hydropower production, water-based recreation, water quality enhancement, and streamflow maintenance also were considered.

A draft reconnaissance report was published in March 1989. The report considered a variety of alternatives ranging from upstream storage dams to water supply pipelines from various sources. It appears that pumping water from the Snake River is the least-cost plan for meeting the water supply needs, but an upstream, multipurpose reservoir at the Laird site also appears feasible. Currently, no local sponsor is prepared to pursue feasibility studies, and no further study by the Corps is recommended at this time.



Palouse River

Clearwater River Basin



CHAPTER SEVEN

Clearwater River Basin

Basin Studies

(Walla Walla District)

The Clearwater River Basin Study included investigations of potential storage developments on the North and South Forks of the Clearwater River and on other tributaries.

Several potential power sites were identified on the South Fork that could be developed to help meet the region's growing need for energy.

In 1988, it was concluded that hydropower generation alone would not justify Corps participation in site development, but investigations also considered opportunities to reduce flood damages and augment streamflows to assist anadromous fish. It was concluded that none of the dam sites were economically feasible.

Emergency levee and channel improvement work has been accomplished at various times throughout the basin. Corps projects were built on Mission Creek near the St. Joseph Children's Home, Lapwai Creek at Culdesac, Cottonwood Creek at Sweetwater, and Big Canyon Creek at Peck.

Revetted levees were constructed in 1949 along the right bank of the Clearwater River near Orofino and up the right bank of Orofino Creek. In addition, channel improvements were accomplished at various times under emergency authorities. The Orofino Creek flood potential was defined in a 1972 report, but reconnaissance reports in 1962, 1968, and 1974 concluded that further structural measures, including levees, flood walls, upstream storage, and channel improvements were not economically feasible.

Mission Creek

A levee was constructed along the right bank and the channel was enlarged near the St. Joseph Children's Home, 20 miles southeast of Lewiston. Construction was authorized by the Office of the Chief of Engineers under the authority of the Flood Control Act of 1956 (Public Law 84-685). The project was completed in 1965 at a Federal cost of \$55,000.

Damages prevented by the project are unavailable since no gauge is available to determine flows applicable to this site.

Lapwai Creek, Culdesac

The Lapwai Creek project was authorized by the Office of the Chief of Engineers under the authority of the Flood Control Act of 1962 (Public Law 87-874). The project consists of a levee, riprap, and channel enlarging and realignment through the village of Culdesac to prevent damages to homes, streets, bridges, business properties, and the water system. Construction was completed in 1971 at a Federal cost of \$177,000. The project has prevented \$493,000 in flood damages through 1995.

Potlatch River, Kendrick

Construction of a revetted levee along the right bank of the Potlatch River through a portion of the village of Kendrick was authorized by the Flood Control Act of 1950. The project was completed in 1959 at a Federal cost of \$60,000. This improvement provides protection against overbank flow and inundation of the business district and other sections of the town. Past floods caused extensive damage and loss of human life. Damages prevented by the project are unavailable since no gauge is available to determine flows applicable to this site.

Bear Creek, Kendrick

Construction of flood control improvements along the left bank of Bear Creek was authorized by the Office of the Chief of Engineers under the authority of the Flood Control Act of 1962 (Public Law 87-874). The channel was improved and a revetted levee constructed to protect private dwellings and property of the Kendrick Consolidated School District. Construction was completed in 1969 at a Federal cost of \$134,000. Damages prevented by the project are unavailable since no gauge is available to determine flows applicable to this site.

Dworshak Dam and Reservoir

Dworshak Dam and Reservoir is in the Clearwater River Basin of northern Idaho along the North Fork of the Clearwater River. The headwaters of the North Fork originate in the Bitterroot Mountains.

The North Fork of the Clearwater River is a major flood-producing stream, and the Dworshak project is an

important unit in the Columbia Basin flood control system. In addition to flood control, Dworshak generates electrical power, and the reservoir's 53-mile length provides navigation benefits through transportation savings for movement of marketable logs from the forest to a log-handling facility at the dam.

The dam is on the North Fork Clearwater River, 1.9 miles above its confluence with the Clearwater River. It has a maximum structural height of 717 feet and a crest length of 3,287 feet.

Construction of the project started in 1963, and it became operational for flood control in 1972. Flood damages downstream prevented since then have amounted to \$737,000 through 1995.

It is the highest straight-axis concrete gravity dam in the Western Hemisphere and the 22nd highest dam in the world. Only two other dams in the United States exceed its height.

At normal full pool elevation of 1,600 feet mean sea level, Dworshak Reservoir is 53 miles long, has 184 miles of shoreline, and covers an area of 19,824 acres. Total storage capacity is 3,453,000 acre-feet, of which 2,000,000 acre-feet are allocated to joint use (active storage) purposes.

The active storage space is regulated according to guidelines specified in the "Water Control Manual for Dworshak Dam and Reservoir." In general, the reservoir is lowered during the fall and winter and refilled during the spring runoff consistent with the primary purpose of flood control.

Dworshak Reservoir is also being used to provide downstream water for flow augmentation to improve fish migration as required through the Endangered Species Act. The Biological Opinion criteria as defined by the

National Marine Fisheries Service (NMFS) is being used to guide the timing and amount of water used for augmentation.

Water quality at the Dworshak Reservoir is considered excellent. Concentrations of suspended solids are low and sedimentation in the reservoir is minimal. Water is released from the reservoir through multilevel gates at the powerhouse intakes. The temperature of water to be released from the reservoir can be varied by selecting the depth at which release occurs. By this means, downstream water temperatures most suitable for fish production at the Dworshak National Fish Hatchery and the Clearwater Fish Hatchery can be provided.

Initial power installation consists of two 90,000 kilowatt units and one 220,000 kilowatt unit for a total installed capacity of 400,000 kilowatts. The three existing units came on-line in 1973. Space is available for three additional 220,000 kilowatt units for increased power-peaking capability.

A study investigating the feasibility of adding a unit was placed in an "inactive" status in 1981 when local opposition developed and the Governor of Idaho withdrew Statesupport.

All project lands have been acquired except those required to replace the loss of wildlife browse areas from inundation by the reservoir. Wildlife habitat browse development continues on project lands to provide winter browse for elk and deer.

Total Federal expenditures through September 1995 have been \$329,528,296 for construction and \$119,488,487 for operation and maintenance. Through September 1995, the project generated 36.53 billion kilowatt-hours of electrical energy. Average annual revenues are about \$39 million. Revenues from the sale of power by



Dworshak Dam and Reservoir

Bonneville Power Administration are returned to the U.S. Treasury to repay, with interest, construction costs as well as operation and maintenance costs of the project. The total national economic benefit for visitor spending at Dworshak Reservoir in 1994 was \$9,521,000.

Recreation

At full pool, Dworshak Reservoir offers a variety of recreational opportunities, including canoeing, sailing, motor boating, water skiing, fishing, and sight-seeing. Within the 30,000 acres of public lands around the reservoir, the Corps provides numerous opportunities for developed and primitive camping, picnicking, hiking, and hunting.

Dworshak State Park (formerly Freeman Creek) and Dent Acres are two major developed areas with recreational facilities, including campgrounds, shelters, swimming beaches, hiking trails, and day use areas. A group camp was completed in 1987 and opened in the spring of 1988. This area provides sleeping cabins, restrooms with showers, and a lodge with commercial kitchen facilities.

In 1989, the Idaho State Legislature appropriated funds to the Idaho State Department of Parks and Recreation to operate Dworshak State Park. The Corps approved a lease agreement June 12, 1989.

Boat launching ramps are available at all reservoir recreation sites accessible by road.

In 1995, new docks and a fueling facility were constructed at the Big Eddy Marina, replacing the facilities damaged in a 1992 windstorm. The replacement facilities will accommodate 98 vessels.

The Visitor Center at the top of Dworshak Dam provides informative slide programs and displays. Guided tours of the dam and powerhouse start at the Visitor Center. More than 125,800 visitation days were credited to the project and its recreation areas in 1995.

Dworshak Fish and Wildlife Compensation

The North Fork of the Clearwater River has historically supported large runs of steelhead trout and lesser runs of chinook salmon.

In 1910, Washington Water Power Company constructed a dam on the Clearwater River that blocked chinook salmon runs.

Fish ladders were inadequate during times when the salmon migrated upstream, although they worked fairly well for steelhead trout. In the 1960's, the U.S. Fish and Wildlife Service (USFWS) constructed Kooskia National Fish Hatchery to help restore the chinook salmon runs.

By the early 1970's, only 1,000 to 1,750 chinook salmon migrated upstream over the Washington Water Power Dam per year.

When Lower Granite Dam was nearing completion, a decision was made to remove the Washington Water Power Dam. It was removed in 1974. As part of the Lower Snake River Fish and Wildlife Compensation Plan (please see Chapter 3), spring chinook salmon and steelhead trout runs are to be restored in the Clearwater River.

In the early 1980's, facilities to produce 70,000 pounds of spring chinook salmon (1.8 million fish) were added at Dworshak National Fish Hatchery. This hatchery provides compensation for Dworshak Dam and Reservoir on the North Fork of the Clearwater River.

Construction of Dworshak Dam and Reservoir also blocked fisheries access to the North Fork of the Clearwater River. Dworshak National Fish Hatchery, the largest steelhead trout hatchery in the world, was constructed by the Corps to mitigate fishery losses. The hatchery is presently producing 2.3 million steelhead trout annually. The steelhead smolts are released in the middle or South Fork of the Clearwater River.

Clearwater Fish Hatchery was completed in 1992, adding another 91,300 pounds of spring chinook salmon production in addition to 350,000 pounds of steelhead trout in the Clearwater Basin.

The hatchery water supply (from Dworshak Reservoir) contract was completed in 1992.

Since operation of Dworshak National Fish Hatchery began in 1970, the facility has experienced fish culture problems because of the soft water used in rearing. Addition of appropriate mineral ions during critical rearing periods solved most of the problems.

Because of fish production losses due to disease, Dworshak is unable to accomplish its intended levels of mitigation without the use of other fish rearing facilities. In 1982, Infectious Hematopoietic Necrosis (IHN) began to cause severe losses in steelhead trout production at Dworshak. The IHN at Dworshak, subsequently identified as the "Dworshak" strain of IHN, has persisted to date and has resulted in an accumulative total loss in excess of 14 million, or 67 percent, of the steelhead fry in the nursery (as of 1990). Yearly losses have ranged from 25 to 98 percent, totaling 19.5 million fish from an initial 42.5 million eyed eggs. Another 8.6 million eggs from positive (infected) IHN parents have been destroyed. It is strongly suspected that the hatchery becomes contaminated with IHN when contaminated water is pumped into the hatchery; the water having been contaminated from IHN-infected fish in the river at or above the main pump intake.

In an effort to manage around the IHN disease and meet Dworshak's mitigation goals, a large portion of

Dworshak's steelhead trout has been transferred to Kooskia National Fish Hatchery (Kooskia) and to Hagerman National Fish Hatchery (Hagerman) for early rearing purposes. These fish are returned to Dworshak for subsequent rearing. The use of Kooskia began in 1982, following the initial outbreak of IHN at Dworshak. The use of Hagerman began in 1988, following an IHN outbreak in Dworshak steelhead trout being reared at Kooskia. The Dworshak steelhead trout support programs at Kooskia and Hagerman were intended to be temporary measures until a permanent solution to Dworshak problems could be implemented. However, the ongoing disease problem at Dworshak has required the continued use of these programs. The use of Kooskia and Hagerman for support of Dworshak has been at the expense of other programs that could be put in use at Kooskia and Hagerman. The USFWS estimates the annual value of these programs to be \$488,000.

The April 1990 discovery of the "chinook" or "Lyons Ferry" strain of IHN in Dworshak chinook smolts has serious and far-reaching implications. This strain of IHN, which primarily affects chinook salmon, has caused significant mortalities at other hatcheries. Combined with the current losses in chinook salmon production from bacterial kidney disease, production losses due to chinook IHN would seriously impact the chinook salmon program at Dworshak.

Maintaining the current level of chinook salmon production at Dworshak is important because of the current status of the chinook salmon on the endangered species list.

Early rearing water for Dworshak was taken from the Clearwater Fish Hatchery water supply starting in 1993. Thus far, this has been an effective means of dealing with the IHN problem at Dworshak. Losses to IHN in 1993 through 1995 were at acceptable levels, indicating that this modification was a success.

Dworshak Hatchery is in need of rehabilitation to correct safety problems, reduce operation and maintenance costs, and to assure that the hatchery can continue to meet the Corps' mitigation goals. Modification and repair of the facilities is being accomplished under the Operations and Maintenance budget as funds become available. Changes in operation to meet the Biological Opinion of the NMFS require additional modification at the hatchery to provide correct temperatures for fish production. Funding is being sought under the Columbia River Fish Mitigation Program, which was established to meet Biological Opinion requirements.

The North Fork Clearwater River drainage also is important for wildlife because it supports significant herds of white-tailed deer, mule deer, Rocky Mountain elk, and lesser numbers of ruffed grouse, black bear, and other

game species. The greatest impact of the construction of Dworshak Dam and Reservoir identified by the Fish and Wildlife Service was loss of winter range, primarily for Rocky Mountain elk and secondarily for white-tailed deer.

To offset this loss, several successful attempts have been made to develop mitigation lands that could be managed for winter range. Intensive development of wildlife mitigation lands includes harvesting the usable timber, hand-cutting brush or mechanically crushing it down, burning brush and slash, replanting and reseeding desirable vegetation, and fertilizing. This work reduces plant succession and increases the production of brush preferred for deer and elk winter feed. Some standing timber is left to provide thermal cover and visual breaks along roads, a buffer along the reservoir, and protection along streams. The result is a mosaic of brush fields and timberlands similar to that which naturally occurs after lightning-caused spot fires.

The Corps obtained title to 5,120 acres adjacent to project lands at the junction of the North Fork and Little North Fork Rivers. These lands, along with 3,900 acres of existing project lands, were developed for winter range.

In 1982, the Corps entered into a cooperative agreement with the Idaho Department of Fish and Game whereby winter range would be developed to varying degrees upon the remaining 27,000 acres of project lands surrounding the reservoir.

Approximately 1,200 acres of project lands already had been developed as "interim mitigation" lands during the early and mid-1970's while negotiations were under way for the 5,120-acre parcel. Development of the remaining winter range areas began in fiscal year 1985.

To date, some 9,113 acres are being managed specifically for elk habitat. A mitigation goal was proposed by the Idaho Department of Fish and Game to provide sufficient browse to sustain 915 elk through a 100-day winter period. Aerial census conducted during 1988-90 resulted in more than 1,000 elk being counted.

The Bonneville Power Administration (BPA) has administered a wildlife loss assessment under the Northwest Power Planning Council's Fish and Wildlife Program. The assessment was conducted by an interagency team using the Habitat Evaluation Process (HEP). Losses were identified and mitigation plans developed for elk in addition to other HEP evaluation species. Resolution of disease and culture problems at Dworshak National Fish Hatchery and maintenance of the previously developed elk mitigation lands are high priorities of the Corps, the U.S. Fish and Wildlife Service, and the Idaho Department of Fish and Game.

In March 1992, the Idaho Department of Fish and Game signed a Wildlife Mitigation Agreement for Dworshak Dam with BPA and the Nez Perce Tribe. Under the agreement, BPA acquired the 60,000-acre Pene

lands and the timber rights to 130 acres of old growth in the Buck Creek drainage. BPA will quitclaim the deeds to these properties to Idaho Department of Fish and Game upon completion of the National Environmental Policy Act process. BPA also will deposit funds in the Dworshak Wildlife Mitigation Trust Fund to provide for river otter mitigation projects being administered by the Nez Perce Tribe and annual operation and maintenance of the Pene lands.

Idaho Department of Fish and Game has indicated to the Corps by letter that the Corps' mitigation responsibility for elk, based on production of browse, has been satisfied, provided the Corps maintains all existing mitigation areas for the purpose for which they were designed. Since the mitigation agreement based on browse production was completed, significant clearcutting of timber has occurred on lands surrounding Corps land at Dworshak. Many of these areas provided thermal cover for elk, which is one of the necessary components for winter range. Many of these same areas now are contributing toward the sustenance browse requirement. The Corps is submitting annual budget requests to undertake a habitat analyses of this winter range area to

determine whether the necessary habitat components are being provided in optimal proportion. This will help the Corps and surrounding landowners define and adjust future habitat management activities.

Due in large part to past and current mitigation efforts, the people of Idaho and the surrounding region have seen a return to historical numbers of elk and white-tail deer. They have also seen some increase in the numbers of other game and non-game species, including steelhead trout.

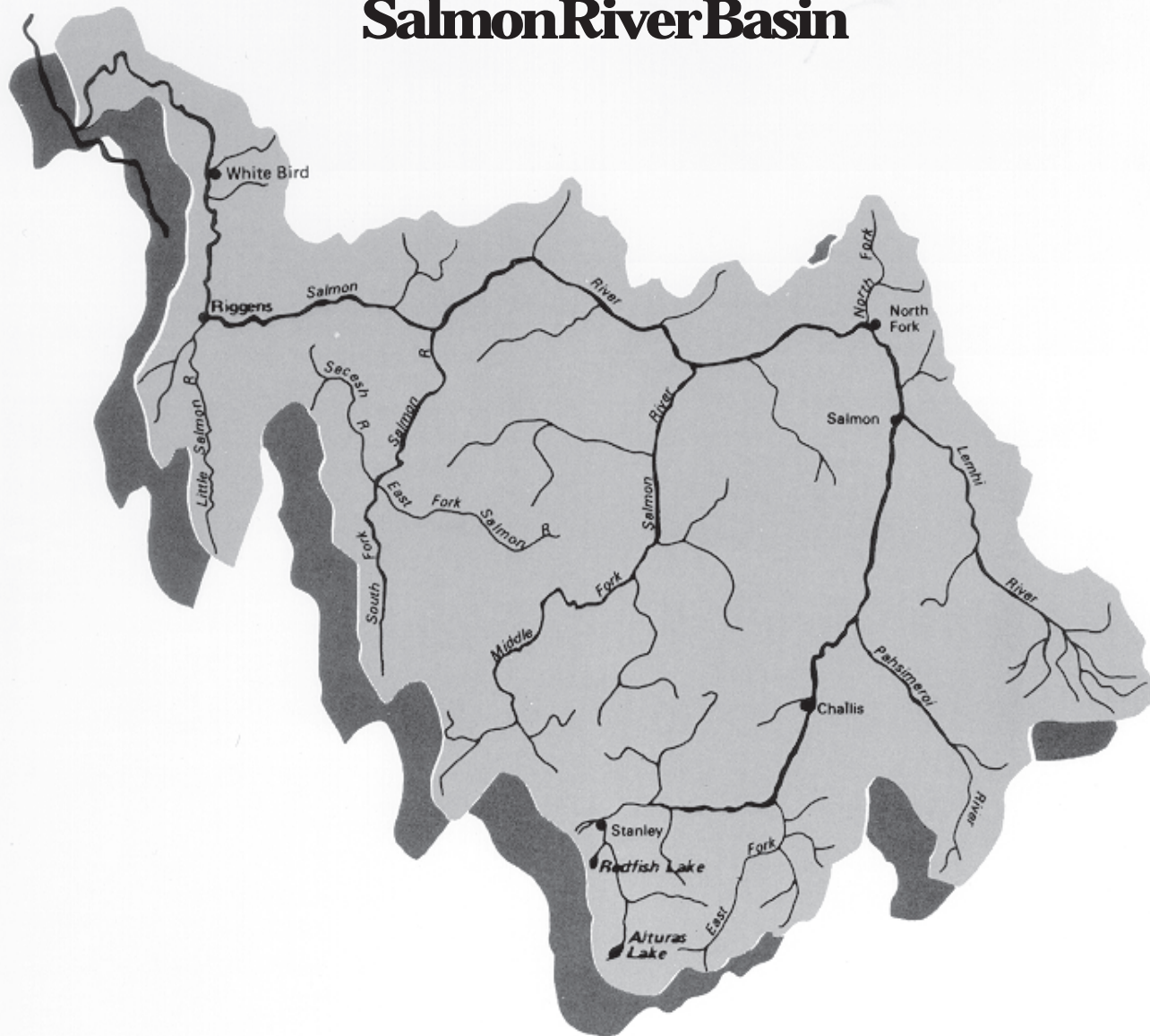
South Fork Clearwater River Levees

Levees protecting Stites and Kooskia along the South Fork of the Clearwater River were constructed by both the Corps and local interests under emergency authorities. Channel and levee improvements and levee construction along a total of 15 miles of the South Fork were authorized by the Flood Control Act of 1950. A study in 1973 concluded that remaining structural work was not economically feasible. The South Fork project was deauthorized by the Water Resources Development Act of 1986 (Public Law 99-662).



Clearwater Fish Hatchery

Salmon River Basin



CHAPTER EIGHT

Salmon River Basin

Tomanovich-Salmon City Levees

The Tomanovich-Salmon City Levees were authorized by the Office of the Chief of Engineers under the authority of the Flood Control Act of 1950. The flood protection project includes channel improvements and right bank levees with revetments extending along the Salmon River from just upstream of the city of Salmon down to the sewage treatment plant area. Construction on the project was completed in 1955. To date, total Federal expenditures have been \$129,000, and the project has prevented flood damages estimated at \$2,359,000 through 1995.

Salmon River Flood Damage Reduction Study

Ice jam flooding continues to be a problem for the city of Salmon and in the rural areas along the Salmon River for 26 miles downstream and for several miles upstream from Salmon. Rural flooding also is a problem for several miles upstream from Salmon along the Lemhi River.

The first field studies were completed in 1951 and the first levees were constructed in 1954. Emergency work in 1955 included cutting a pilot channel through the Dump Creek debris cone, which acts as an obstruction to the Salmon River downstream from Salmon. However, additional sediment soon covered up the pilot channel. Reports in 1957 and 1961 concluded that further channelization or levee work to control ice jam flooding was not economically feasible. A number of studies were conducted by the U.S. Forest Service in the 1970's, examining sedimentation in Dump Creek and other tributaries. Some of that data was used in a 1981 Corps reconnaissance study that reviewed the overall ice jamming problem. Again, the Corps concluded that a channelization project at Dump Creek was not economically justified.

In 1982, after experiencing one of the more damaging ice jam floods on record, Lemhi County requested that the Corps reexamine the situation, and Walla Walla District called on the services of the Corps Cold Regions Research and Engineering Laboratory in an attempt to gain a better understanding of the ice jam phenomenon.

The results of this study were published in a 1984 report. That report is the basis for a 1986 detailed project report and environmental impact statement that again examined various channelization and levee formats and permanent evacuation of the floodplain. Field studies included an examination of the severe 1984 ice-jamming event.

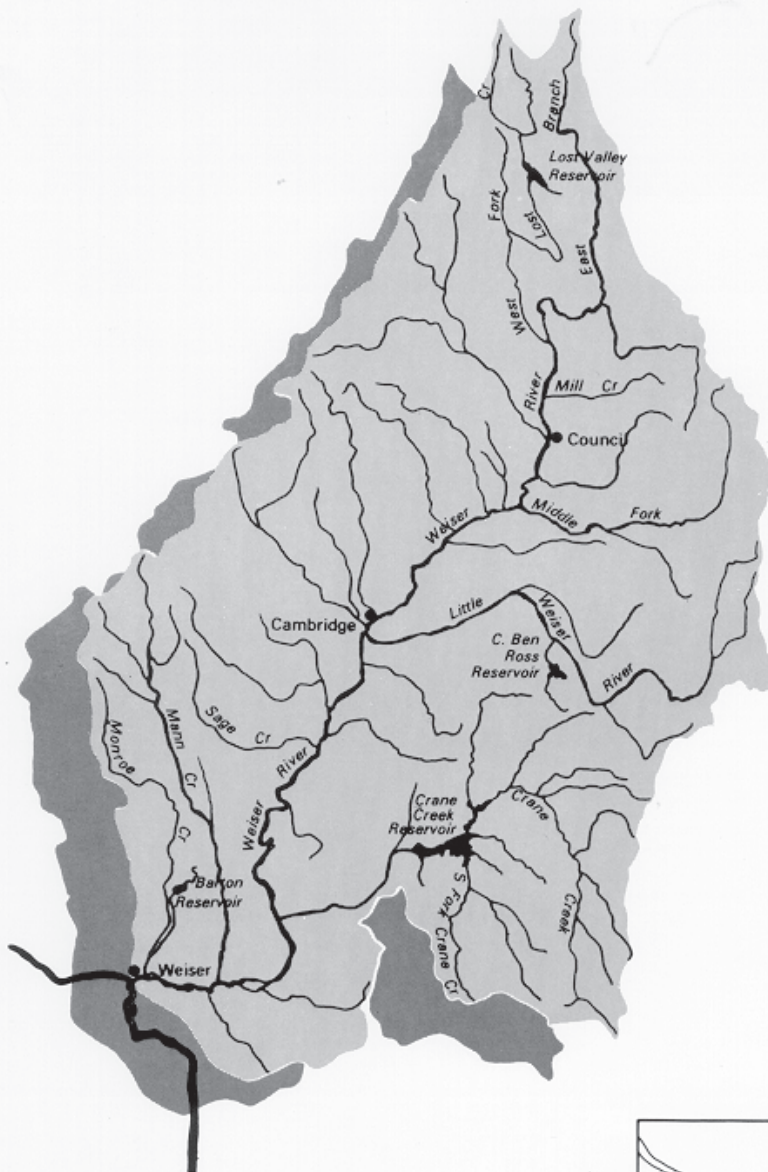
Channelization of the Dump Creek alluvial fan and Deadwater slackwater area was found to be feasible but in conflict with the Wild and Scenic Rivers designation of the proposed work area. The options favored by the report, levees along the Lemhi River or a combination of levees and floodplain evacuation, were not supported by local sponsors. Therefore, the report recommended no further action at this time.

The Cold Regions Research and Engineering Laboratory conducted research and gathered data on ice jamming characteristics in the Salmon River to determine if a low cost facility, intended to induce ice jams upstream from the city of Salmon, is technically possible. The research was part of a Section 205 feasibility study. However, due to loss of local sponsorship, further studies were terminated.

Whitebird Creek Levees at Whitebird

Channel improvements, levees and revetments in the vicinity of the town of Whitebird along about 3.5 miles of Whitebird Creek, upstream from its confluence with the Salmon River, were authorized by the Flood Control Act of 1950. Emergency levee construction and channel work accomplished in 1948 completed the project within the scope of the original authorization, and a 1957 study concluded that additional structural work is not economically feasible. The project was deauthorized as part of the Water Resources Development Act of 1986 (Public Law 99-662).

Weiser River Basin



north



miles



vicinity map

Weiser River Basin

CHAPTER NINE

Weiser River Basin

Weiser River Flood Protection Project

Flood protection works along the 60-mile-reach of the Weiser River downstream of the town of Council and along the lower reaches of the Little Weiser River and Mann Creek were authorized by the Flood Control Act of 1950. The authorized work would provide protection at selected locations with levees, bank protection, and channel improvements. Extensive emergency work was accomplished at selected locations, but the work has had limited effectiveness. A report in 1955 concluded that proposed work in the Weiser, Midvale, and Cambridge areas was feasible, but a 1960 report found economic justification for only the proposed levees in the vicinity of the town of Weiser. The study was placed in a deferred status due to a lack of local interest in sponsorship.

Severe floods in December 1964 and January 1965 led to renewed local interest in flood protection works. However, the focus for new work shifted to the basin study, upstream storage sites, and the proposed Galloway Dam. A proposed restudy of the project has not been funded.

Basin Study

The Weiser River Basin Study, which is part of the Upper Snake River Basin Study, was accomplished in cooperation with the Idaho Department of Water Resources. As part of the study, 49 reservoir storage sites in the basin were identified and reviewed. Five sites were selected for reconnaissance-level studies, including the Galloway, Goodrich, Vista, and Tamarack sites and enlargement of the existing Lost Valley Project. Further study of all sites, except Galloway, was eventually discontinued due to lack of economic feasibility or Federal interest.

Preliminary investigations of the Galloway site indicated that reservoir storage sizes in the range of 600,000 acre-feet to 1,200,000 acre-feet were feasible. A technical report released in August 1990 evaluated a plan for a 900,000 acre-foot reservoir to control flooding in the lower reaches of the Weiser River. Reservoir storage space also could augment downstream river flows in the Snake and Columbia rivers to benefit anadromous fish survival, generate hydropower on site, improve the systems hydropower generation capability during periods

of adverse water conditions (critical periods), and provide recreation opportunities.

The plan was economically feasible and the state of Idaho indicated a desire to act as the non-Federal sponsor. Fishery Agencies indicated a strong interest in developing Galloway to supplement the existing Northwest Power Planning Council fish flow augmentation operation in the Snake River Basin. Following a determination that there were no insurmountable impediments to non-Federal development of the Galloway site, the Weiser River Basin Study was terminated in August 1990. Section 1135 of the Water Resource Development Act of 1986 (Public Law 99-662) provides authority for modifying Corps projects to restore fish and wildlife habitat. These modifications are limited to \$5 million.

Environmental Restoration Project

A Section 1135 project is being studied on the Little Weiser River near Cambridge, upstream approximately 15 miles to Indian Valley. Spring flows are eroding unstable banks, creating sand and gravel bars that block the channel, and subjecting riparian areas and fields to erosion and deposition. As a result of this channel erosion, fish and wildlife habitat along the stream has been destroyed and degraded. In the past, the stream had a well vegetated riparian zone and supported trout and salmon populations.

Channel snagging and clearing work by the Corps in 1965 and 1978 contributed to the channel degradation. Temporary rock and gravel irrigation diversions also disturb the stability of the stream. These problems will continue until some means are found to stabilize the channel. The channel capacity is limited and it is, therefore, likely that erosive flows and flooding will occur quite frequently. The Corps is looking at ways to stabilize the channel to prevent movement of materials and channel erosion in order to prevent further loss of riparian habitat, maintain channel capacity, and restore fish and wildlife habitat. Measures that are being investigated to meet these objectives include: creation of stream meanders, permanent irrigation diversions, installation of rock vortex weirs, streambank stabilization, and restoration of riparian vegetation.

Payette River Basin



CHAPTER TEN

Payette River Basin

Basin Study

Flood flows normally result from snowmelt in the late spring and overtop stream banks in the lower valley about every 2 years. Studies to investigate establishment of a systematic and logical development plan for basin water and land resources would be initiated when funds are appropriated.

Payette Valley Flood Protection Project

The Payette Valley Flood Protection Project was authorized by the Flood Control Act of 1950. The proposed project consists of channel rectification, bank protection, and levees at 17 separate locations. These works extend along the Payette River from Black Canyon Dam near Emmett downstream 38 miles to the Snake

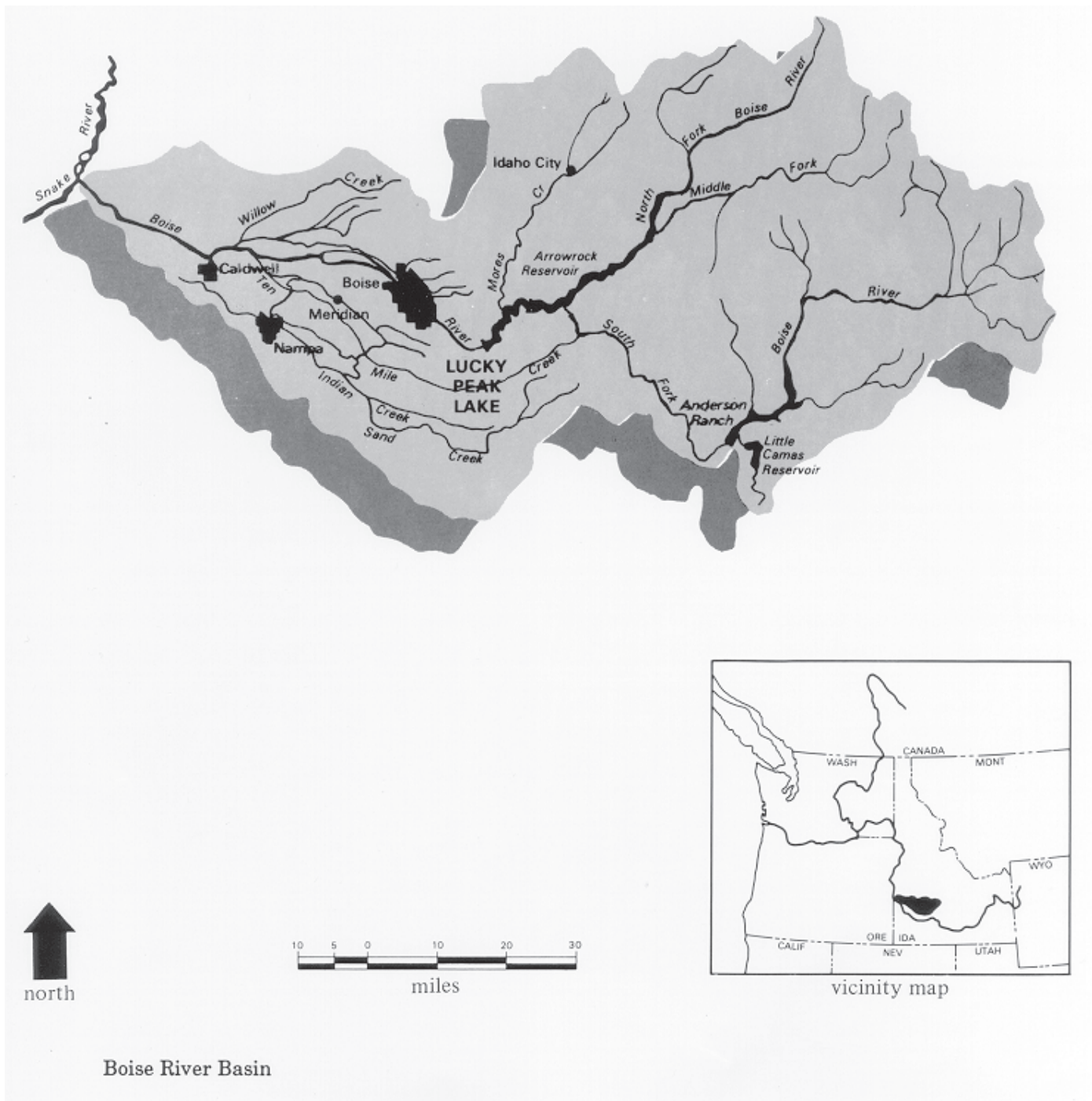
River. The flood protection works would prevent damage to irrigated farm and dairy lands.

Due to lack of economic justification and with the concurrence of local authorities, this project was deauthorized in October 1978. A Flood Management Report for the Payette River was prepared by the Corps, Walla Walla District, at the request of the Idaho Department of Water Resources to permit coordination of work by various individuals and agencies along the Payette River. The primary purpose of the report was to establish proposed levee alignments in the river reach extending from Black Canyon Dam downstream to the mouth of the river. The levees are intended to contain about the 50-year-flood discharge of 28,000 cubic feet per second. The report was completed in 1982.



Payette River near Loman

Boise River Basin



CHAPTER ELEVEN

Boise River Basin

Boise Valley Levees

Channel improvements, levees, and revetments along the Boise River from the city of Boise to the mouth of the Boise River were authorized by the Flood Control Act of 1950. Emergency repair of existing protective works has been accomplished at various times since 1943. The emergency work provided increased protection to Boise and certain valley farmlands and permitted more effective operation of Lucky Peak Dam. Some initial studies concluded that structural alternatives were feasible, but, subsequently, Canyon County withdrew as sponsor. The Canyon County portion of the project was deauthorized in 1967.

A 1976 restudy of the Ada County portion concluded that the proposed structural improvements are no longer economically feasible, although some limited work in combination with nonstructural solutions appeared to have potential. However, there was no interest in further studies and the project was deauthorized by the Water Resources Development Act of 1986 (Public Law 99-662).

Cottonwood Creek Dam (Deauthorized)

An earthfill flood retention dam on Cottonwood Creek at the east city limits of Boise was authorized by the Flood Control Act of 1966. The project was intended to protect urban and residential areas from recurring flash floods. Studies and design memoranda were last revised in 1977, but the local sponsor withdrew support in 1979. The project was deauthorized by the Water Resources Development Act of 1986 (Public Law 99-662).

Like the Cottonwood Creek drainage, other portions of the Boise area also are vulnerable to flash floods. The Stuart Gulch Dam also was authorized by the Flood Control Act of 1966. Studies and design memoranda were last revised in 1973, but after the local sponsor withdrew support for the project, it was deauthorized in 1979. A study was conducted on the feasibility of instituting a flood warning system for the portions of Ada County and the city of Boise subject to flooding. The study was reclassified from active to inactive status on September 19, 1995.



Mores Creek - Lucky Peak Lake



Lucky Peak Dam and Powerhouse

Lucky Peak Lake

Lucky Peak Lake is a Corps project in the mountains of southwestern Idaho on the Boise River, 10 miles southeast of the city of Boise.

It was constructed primarily for flood control along the main stem of the Boise River. In conjunction with two upstream reservoirs, Lucky Peak Project provides a high degree of flood protection in a 60-mile area extending from Lucky Peak downstream through the city of Boise to the mouth of the Boise River. Completed in 1955, its authorized project purposes are flood control, irrigation, recreation, fish and wildlife, and streamflow maintenance.

Lucky Peak Dam is a rolled earthfill structure about 340 feet high and 1,700 feet long. It has an intake tower, two outlet tunnels, a powerhouse and a 600-foot free-overflow spillway. At full pool, the lake behind the dam is about 12 miles long with about 3,000 acres of surface area. The reservoir has a storage capacity of 307,043 acre-feet, of which 264,371 acre-feet are allocated to joint use (active storage) purposes.

In 1980, the Federal Energy Regulatory Commission issued a license to the Boise Project Board of Control to construct an 87-megawatt power plant at the existing project. A 2-year license extension was granted in 1982. In 1988, the licensee completed the construction of the powerhouse project and the first power came on-line.

The project included relining of the original outlet tunnel and construction of a second outlet works for Lucky Peak Dam, which is completely separate from the original outlet works. The construction project also included measures to improve recreation and operational facilities. Through an agreement with the Board of Control, Seattle City Light operates the 101,250-kilowatt-capacity powerhouse and markets the power. Controlled discharge of impounded water is accomplished by means of two outlets. The original outlet is a steel-lined, concrete pressure tunnel 22 feet in diameter connecting a 260-foot intake tower with a recently constructed powerhouse. Any water not routed through the powerhouse is dispersed into a rock-stilling basin with flip buckets.

During construction of the powerhouse and relining of the first outlet, a second steel-lined outlet was bored through the downstream left bank abutment. This outlet is 12 feet in diameter, has a separate intake works, and water is released through two cone valves.

Lucky Peak Lake storage is regulated in conjunction with Arrowrock and Anderson Ranch reservoirs upstream on the Boise River. These two projects were constructed by the Bureau of Reclamation before construction of Lucky Peak Dam by the Corps. The three reservoirs are operated as an integral system under the guidelines of the "1985 Joint Water Control Manual - Boise River." It is the intent of the flood control regulations to limit river

flows at the Glenwood gauge near Boise to 6,500 cubic feet per second for all but the largest flood discharges. The operating plan also is designed to keep a full pool at Lucky Peak as long as possible during the summer recreation season.

Through September 1995, federal expenditures for Lucky Peak project have totaled \$19,652,081 for construction and \$19,655,652 for operation and maintenance. Since 1961, flood damages prevented have been estimated at more than \$183,642,000. Total national economic benefit for visitor spending at Lucky Peak Lake in 1994 was \$29,826,000.

Fish and Wildlife and Recreation

A total land area of 4,288 acres is contained within the project boundaries. Project lands are designed for multiple uses, including operations, recreation, and wildlife. The project lies within the Idaho Department of Fish and Game's Boise River Wildlife Management Area, a major game range in the state. Recreation facilities are at 10 major and minor sites. The Sandy Point and Spring Shores units of Lucky Peak State Park are operated by the Idaho Department of Parks and Recreation.

Lucky Peak State Park has received the highest visitation of any state park in Idaho. The remainder of the recreation areas are operated by the Corps. Recreation uses include boating, water-skiing, fishing, swimming, sunbathing and picnicking. More than 774,600 visits were credited to Lucky Peak recreation sites in 1995.

Numerous improvements of the recreation facilities were accomplished during construction of the hydropower project. Parking facilities and a boat ramp were expanded at the Barclay Bay-Turner Gulch site. The access road to the Barclay Bay-Turner Gulch site was relocated to provide additional parking and increased safety. Expansion at the Sandy Point Unit of Lucky Peak State Park included additional trees and lawn, a new amphitheater, extension of the bike path from the Discovery Unit to the Sandy Point Unit, and measures to improve the appearance and water quality at the swim beach.

In 1994, the Corps replaced restrooms at the Barclay Bay and Turner Gulch recreational areas.

Separately from the hydropower project, the Corps replaced rest rooms at the Mores Creek and Macks Creek recreation sites. The Idaho Department of Parks and Recreation has replaced the marina docks at the Spring Shores Unit of Lucky Peak State Park. The Idaho Department of Parks and Recreation, in cooperation with the Corps, is providing a complete remodel of the Spring Shores State Park and marina unit, including restrooms and facility upgrades. The work is to be completed by 1997.

A project land interchange was completed with the U.S. Forest Service in 1988. The interchange eliminated dual jurisdiction on lands within the project. This consolidation of land management responsibilities maximizes the overall benefits derived from the project.

The operation, recreation and wildlife activities of the project are guided by the updated Lucky Peak Master Plan which was approved in July 1988.

Arrowrock and Anderson Ranch Dams

Arrowrock and Anderson Ranch Dams are upstream of Lucky Peak Dam. Originally, these projects were authorized primarily for irrigation and secondarily for power production. They are owned and operated by the Bureau of Reclamation.

After construction of Lucky Peak Dam, operation of the three projects was integrated to benefit flood control during spring runoff and irrigation at other times. Hydropower remains a secondary use. Other important uses are streamflow maintenance, recreation, and fish and wildlife benefits.

Lake Lowell and its associated facilities, the Boise River Diversion Dam and the New York Canal, are included in the interagency agreement specifying operational criteria for the Boise River Reservoir System. Lake Lowell, an offstream reservoir southwest of Boise, is used primarily for irrigation storage.

Arrowrock Dam is on the Boise River, 15 miles east of Boise and immediately upstream from Lucky Peak Lake. It consists of a concrete arch structure with a structural height of 354 feet. Crest length is 1,150 feet. No power production facilities were included in the project.

The lake behind the dam has a total storage capacity of 298,230 acre-feet of which 286,600 acre-feet are allocated to joint-use (active storage) purposes.

Initial construction on Arrowrock Dam was completed in 1917 by the Bureau of Reclamation. The dam was subsequently raised to its current height in 1937. Project lands are administered by the U.S. Forest Service. Recreational opportunities are somewhat limited due to the mode of operation of the project and its relative isolation.

Anderson Ranch Dam is on the South Fork of the Boise River about 43 miles southeast of Boise. The dam is a 456-foot-high, rolled earth and rockfill structure. Crest length is 1,350 feet. It includes a hydroelectric power plant with installed capacity of 27,000 kilowatts. The lake behind the dam has a total gross capacity of 503,682 acre-feet of which 418,178 acre-feet are allocated to joint use (active storage) purposes.

Construction on Anderson Dam was completed by the Bureau of Reclamation in 1950. Recreation facilities around Anderson Ranch Reservoir include three

campgrounds and five boat launching ramps. Existing facilities are generally primitive, but all sites are accessible by road. The lake is noted for large catches of trout. Annual visitors total more than 30,000.

Excellent trout fishing is available downstream from the dam, a result of stabilized river flows and intensive efforts on the part of the Idaho Department of Fish and Game. The Bureau of Reclamation attempts to maintain minimum stream flows through the South Fork reach below Anderson Ranch Dam.

One goal of the operational plan for the Boise River reservoirs is to maintain the Lucky Peak recreational pool as late into the summer recreation and irrigation seasons as possible due to its proximity to the city of Boise. This is accomplished at the expense of recreational opportunities at Arrowrock by drafting water first from Arrowrock Lake. During very dry years, irrigation demands also require drafting both Anderson Ranch and Lucky Peak reservoirs below full pool levels before the end of the normal recreation season.

Floodplain Management Report

The Floodplain Management Report for the Boise River was prepared by the Walla Walla District at the request of the Idaho Department of Water Resources to permit coordination of work by various individuals and agencies along the Boise River. The primary purpose of the report was to establish proposed levee alignments in the river reach extending from Boise downstream to the mouth of the river. The report was completed in 1979 and revised in 1982.

Urban Study

The Boise Valley Regional Water Management Study was one of nine studies initiated in fiscal year 1972 in the Corps urban studies program. This study was carried out under the joint leadership of the Ada County Council of Governments, Canyon Development Council and the Corps. The lower Boise River passes through Ada County and then Canyon County before flowing into the Snake River.

Ada County, which includes the capital city of Boise, contains 20 percent of the State's population. From 1980-90, Ada County accounted for 54 percent of the state's population growth. Boise and Ada counties are experiencing problems common to most rapidly growing urban areas.

The study included development of wastewater facility plans for the Nampa-Caldwell area and area-wide wastewater plans for the Boise Valley to meet stringent requirements of the Clean Water Act. The area-wide plans included treatment and disposal of

wastes from septic tanks, municipal wastewater and storm runoff, and agricultural feedlot sources.

Other features of the study were flood damage reduction measures for Caldwell, the Boise foothills, and the Boise River floodplain; improvements in water supply facilities for the city of Boise; reduction of sedimentation and pollution from irrigation operations; and proposals to rehabilitate Barber Dam. The study was completed in 1977.

Lower Boise River and Tributaries Study

A reconnaissance study was initiated in fiscal year 1994 to evaluate the water resource problems in the Lower Boise River. The purpose of the study was to identify the problems and determine if there was local interest in continuing into the feasibility level of study. However, due to lack of local sponsorship, the reconnaissance study was reclassified from active to inactive status. The recommendation was included in an interim reconnaissance report, dated May 1995.

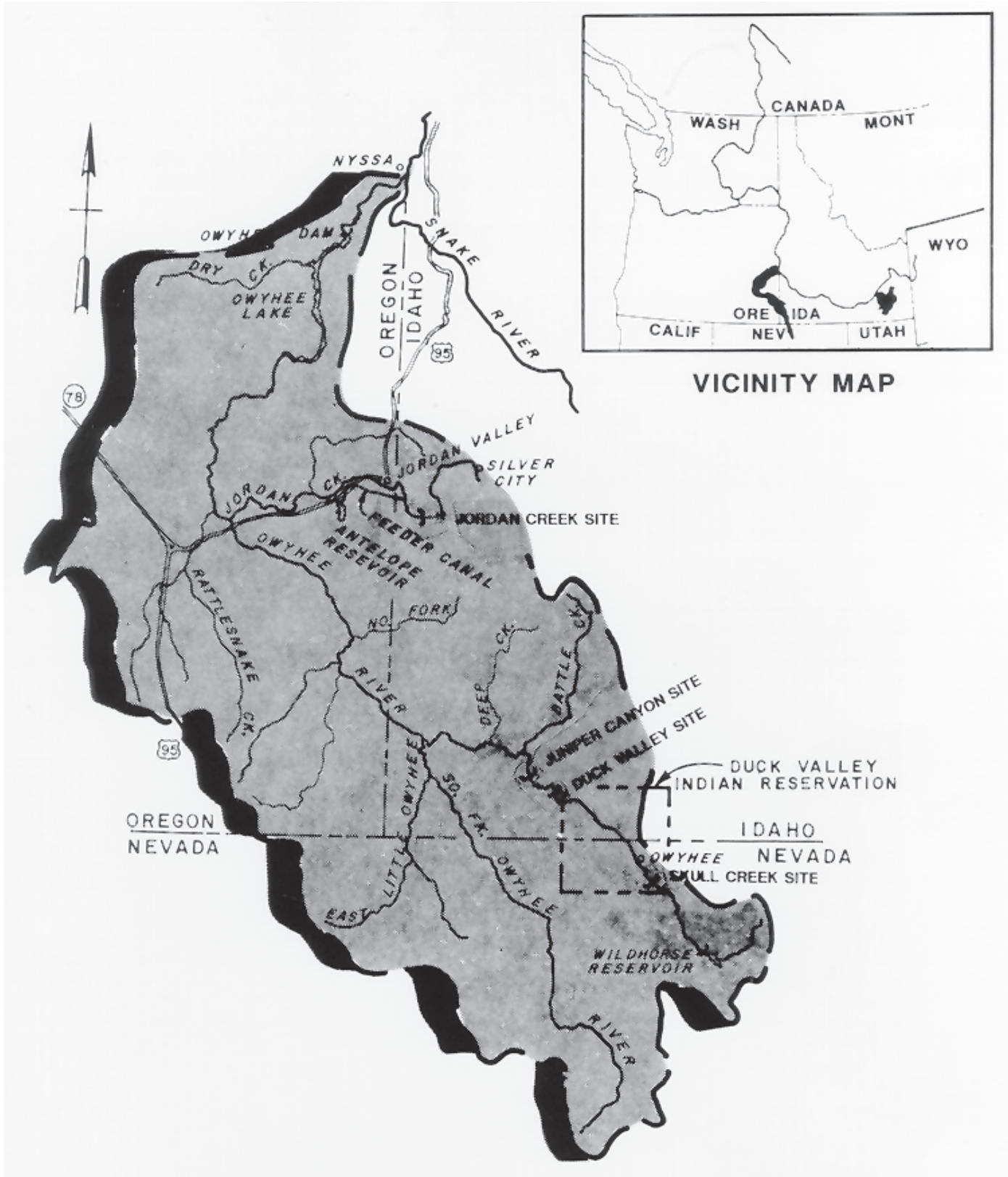


Barclay Bay



Boise River Flood

Owyhee River Basin



CHAPTER TWELVE

Owyhee River Basin: Idaho, Oregon, and Nevada

The Owyhee River is one of the more important southern tributaries to the Snake River. It drains a high plateau of about 11,300 square miles of which about 6,200 square miles are in Oregon, 2,800 square miles are in Idaho, and 2,300 square miles are in Nevada. The principal tributaries are the North Fork, East Fork (or Middle Fork), South Fork, and Jordan Creek.

Except for a few scattered ranches in the small valley areas, development has been limited to the Duck Valley Indian Reservation, the Jordan Creek Basin, and the large land area below Owyhee Reservoir. In addition to Owyhee Reservoir, principal existing irrigation storage projects include Antelope Reservoir in Jordan Valley and Wild Horse Reservoir on the Duck Creek Indian Reservation. Additional storage in the basin could provide irrigation water, augment flows for fish, and generate hydropower as well as reduce flood damages.

As part of the Upper Snake River Basin Study, the Corps studied three potential dam sites on the East Fork

of the Owyhee River: a site about 5 miles downstream of Juniper Canyon, a site just downstream of the Shoshone-Paiute Indian Reservation, and the Skull Creek site on the Shoshone-Paiute Indian Reservation.

Preliminary investigations of the three multipurpose storage sites on the East Fork were completed in January 1988.

The investigations, released as the Owyhee River Basin Interim Study, also looked at a dam site on Jordan Creek about 12 miles upstream from Jordan Valley in Idaho and the possibility of enlarging the Antelope feeder canal and reservoir for flood storage. The Jordan Valley study was in response to a request from Oregon Representative Robert F. Smith on behalf of the Jordan Valley Irrigation District and other concerned local citizens. The study concluded that none of the alternatives were economically feasible, and it recommended no Federal involvement at that time.



Owyhee Dam

Big Wood River Basin



CHAPTER THIRTEEN

Big Wood River Basin

Gooding Area Flood Protection

Channel improvements on Little Wood River at Gooding and Shoshone were authorized by the Flood Control Act of 1950. The city of Shoshone later canceled sponsorship of its portion of the project. Improvements in the Gooding-Shoshone area included stream control structures, channel enlargement, and a diversion dam in the old channel for flow dispersion into a lava sink. Construction was completed in 1954 at a Federal cost of \$86,126. Damages prevented by the project are unavailable since the gauge has been discontinued.

Basin Study

The Big Wood River originates in the Sawtooth Mountains of south-central Idaho. Its principal tributaries are Camas Creek, which enters the river from the west below Hailey, and the Little Wood River, which joins the Big Wood from the east at Gooding. The Little Wood River arises in the Pioneer Mountains, an easterly extension of the Sawtooths. Both rivers flow generally south and west. From the confluence of the Big Wood River, a distance of about 10 miles, the stream is known

as the Malad River. Major impoundments include Magic Reservoir (at the confluence of Camas Creek and the Big Wood River) below Hailey and Little Wood River Reservoir above Carey. Magic Reservoir is used primarily for irrigation. Little Wood River Reservoir is regulated for both flood control and irrigation. Smaller irrigation reservoirs are along tributaries to the Little Wood River. Flood damage occurs in the Hailey-Ketchum area, the Gooding-Shoshone area, the Carey Valley, and near Fairfield.

The Big Wood River and Tributaries Study was authorized by resolutions adopted in 1948 and 1952 by the U.S. Senate Committee on Public Works. The study was intended to review prior reports on the Snake River Basin and to determine the feasibility of flood protection on both the Big Wood River and the Little Wood River. A Senate Resolution of September 1976 expanded the study authority to include water supply and wastewater management.

Reports were prepared under the above authority and under various small project authorities in 1950, 1953, 1957, 1961, 1965, and 1976. Identified water resource needs were flood protection, supplemental irrigation water, water-oriented recreation, and increased streamflow during low-flow periods. Preliminary studies



Big Wood River Basin

indicated flood control projects in the Gooding-Shoshone area were the only economically justifiable proposals. Projects in the Hailey and the Carey areas were rejected either due to the lack of economic feasibility or the lack of a local sponsor. The Little Wood near Carey project was deauthorized in 1965. Work in the Hailey area has been limited to channel clearing and emergency flood fights.

Flood protection works in the Gooding area along the Little Wood River were specifically authorized in 1950 and completed in 1954. Additional channel work was completed in both the Gooding and Shoshone areas during emergency flood fights in the years 1957 to 1964. However, flooding continues to be a problem in this area along both the Big Wood and Little Wood Rivers.

A feasibility report on the Gooding-Shoshone flooding problems was published in 1976. The report recommended construction of diversions at two locations to route floodwaters into offstream ponding facilities in the adjacent lava fields. The floodwaters eventually would be dissipated through percolation and evaporation. The project was specifically authorized by the Water Resources Development Act of 1986 (Public Law 99-662). Studies were initiated in fiscal year 1990 to review the 1976 feasibility report in light of current needs and developments that have taken place since 1976. A reevaluation study was completed in July 1992. Although the project was found to be economically feasible, further studies were terminated due to lack of local support.

Subsequently, the Idaho Water Resources Board provided a letter of intent to act as the project sponsor in 1994. The board is interested in adding a groundwater recharge as a project purpose in addition to flood control. In 1994, the Idaho Water Resources Board provided a letter of intent to act as the project sponsor. The board is interested in adding a groundwater recharge as a project purpose in addition to flood control. On the basis of that letter, the project was reclassified to active status.

Soldier Creek Environmental Restoration Project

Section 1135 of the Water Resource Development Act of 1986 (Public Law 99-62) provides authority for modifying Corps projects to restore fish and wildlife habitat. These modifications are limited to \$5 million.

A Section 1135 project is being studied on Soldier Creek, which originates in the Soldier Mountains, approximately 15 miles northwest of the city of Fairfield, Idaho. It flows generally in a southeast direction to its confluence with Camas Creek, which is located about 5 miles southeast of Fairfield. The Soldier Creek drainage basin has an area of 58.9 square miles.

Over time, Soldier Creek has experienced a loss of fish and wildlife habitat, erosion of the channel, deposition in the lower riparian zone and some flooding along the main channel. Runoff has become concentrated in Soldier Creek and additional streams have been cut off. The deeply incised channel has eliminated bank storage and the high water table that existed in the riparian areas along the stream. These areas contributed to a longer duration base flow in the past and helped provided perennial flow. As a result, much of the riparian vegetation has died, and the stream often dries up early in the summer. This condition has been aggravated by the previous Corps clearing and snagging construction in 1957 and 1960.

A once thriving trout fishery in this area is now very limited and is a very scarce resource. Loss of the riparian vegetation and perennial stream flows in the Soldier Creek stream complex has resulted in greatly reduced populations of all bird and animal species in the area.

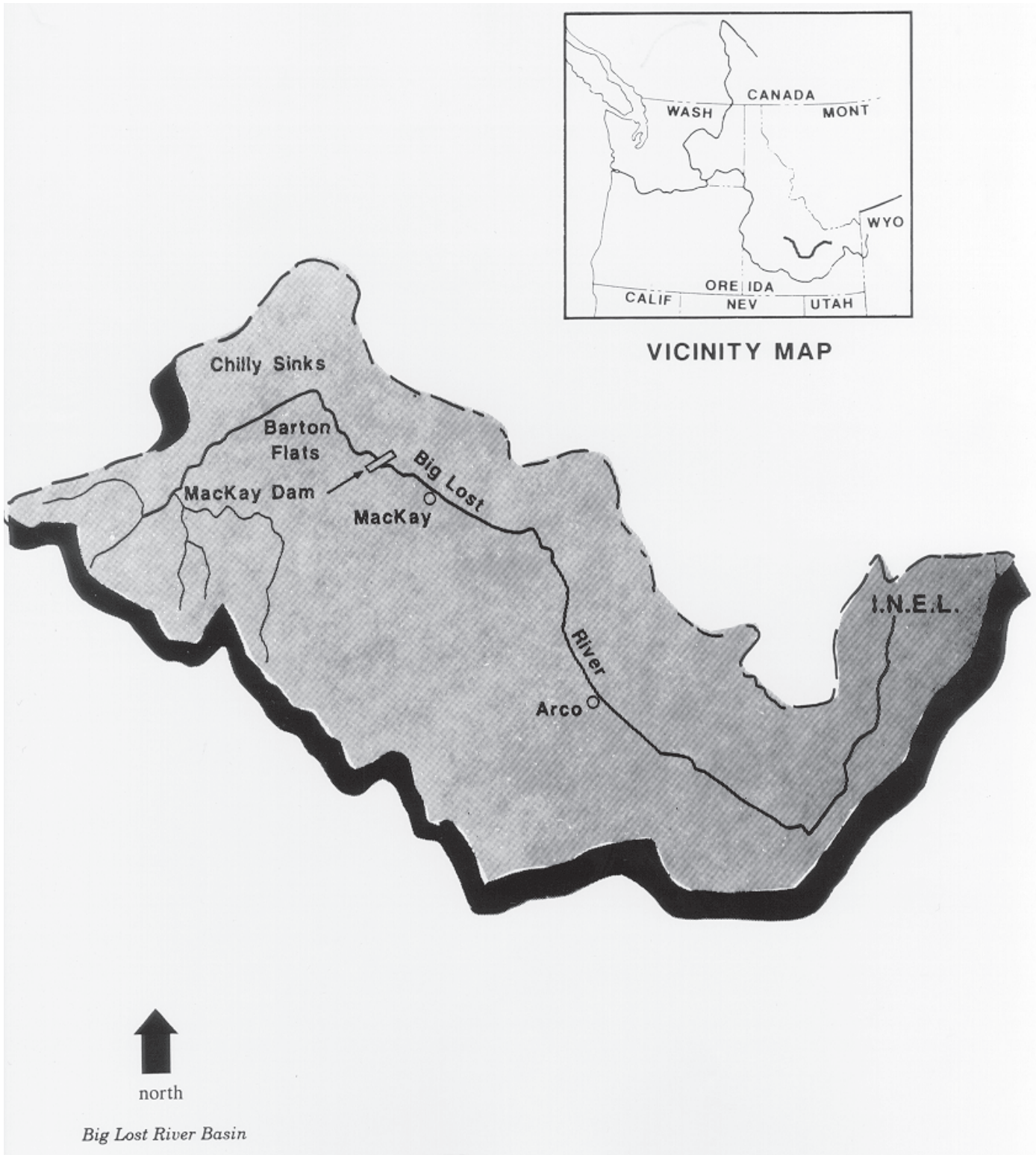
Other tributary streams to Camas Creek have suffered similar conditions, and the combined effects on the Camas Prairie have affected most all local species. The area was formerly an excellent nesting area for sandhill cranes. An effort has been made to use the cranes to raise the endangered whooping crane population by using them as surrogate parents. Whooping crane eggs placed in the nests of sandhill cranes are hatched out and the whooping cranes migrate with the sandhill cranes. Proposed improvements to stabilize the channel, reduce flooding, and restore fish and wildlife habitat include:

- Construction of a rock diversion structure to divert water during high flow periods into the three adjacent creek channels.
- Installation of rock weirs.
- Installation of a diversion structure and diversion channel to divert high flows through an abandoned gravel pit. The pit serves as a sediment trap and allows restoration of a badly eroded channel section. Pit bank shaping to restore wetland habitat.
- Replanting riparian vegetation on 100 acres along channels with native plants.



Big Wood River

Big Lost River Basin



Big Lost River Basin

Basin Study

The Big Lost River Basin Study was conducted under the Upper Snake River Study authority at the request of local and state agencies. The study evaluated alternatives that would reduce flooding along the Big Lost River.

Damaging floods occur frequently in the 28-mile reach between Mackay Dam and Arco when river flows exceed channel capacity. The flood of May-June 1967 was the largest to date and inundated some 7,000 acres. It caused \$800,000 in damages. The smaller, more frequent floods have damaged agricultural lands, bridges, roads, and Idaho National Engineering Laboratory property downstream of the town of Arco. Twelve major floods have occurred since 1943. In 1983, an earthquake caused land subsidence and increased the potential for flooding problems. In 1986 and several other years, losses have exceeded \$1 million.

There was concern that a major flood could exceed the spillway capacity of Mackay Dam and cause a dam failure. The resulting flood would cause considerable damage to Mackay, Arco and Idaho National Engineering Laboratory facilities. The possibility also exists that the Snake River Plain aquifer would be contaminated with radioactive waste from the Idaho National Engineering Laboratory in a major flood. However, recent studies indicate that spillway capacity of Mackay Dam is adequate.

Corps involvement with local interests was requested by a citizens group on November 25, 1986. The citizens group included the Soil Conservation Service, the Butte Soil Conservation District, Butte County Commissioners, Custer County Commissioners, and the Big Lost River Irrigation District. The Idaho National Engineering Laboratory was also very interested in the study.

The Big Lost River Study also considered the potential for benefits due to increased water supplies and hydro-power generation with each alternative solution. River flow is often erratic due to loss of water into two major sink areas along the channel (Chilly and Darlington). Irrigation water delivery is sometimes undependable due to time lag through the sink areas. Some 24,000 acres would be available for irrigation if additional water supplies were developed. Increased water supplies could also be used for streamflow maintenance, fish and wildlife enhancement, and recreation.

A draft preliminary report was released in December 1988. It investigated the following alternatives: enlarge the capacity of Mackay Reservoir; enlarge the emergency

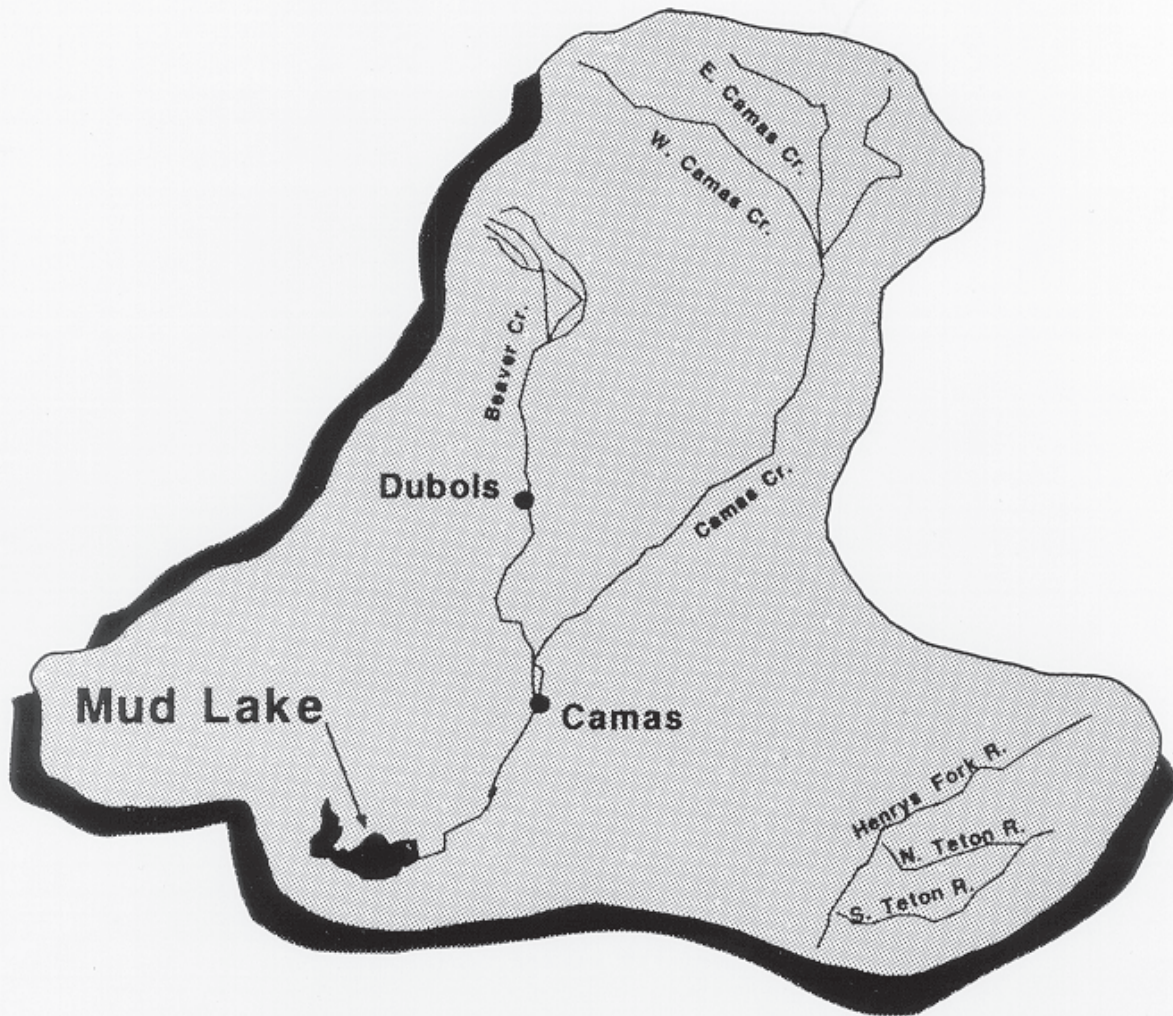
spillway capacity of Mackay Dam; regulate the existing capacity of Mackay Reservoir for flood control; construct a new dam on Antelope Creek; examine the opportunities for upstream storage above Mackay Dam; divert flood flows into the Chilly Sinks and Barton Flats areas; divert flood flows into U.C. Canal and extend the canal to desert areas of the Snake River plain, building levees to protect specific sites. The preliminary study showed that diversion of flood flows into the Chilly Sinks and Barton Flats areas is the most economical solution.

Based on the favorable results shown in the Preliminary Report, a feasibility study was initiated in May 1989. On January 8, 1990, Butte County signed a letter of intent to enter into a Local Cooperation Agreement assuming a favorable and acceptable project. A final feasibility report released in September 1991 concluded that developing storage and diverting flood flows into the Chilly-Barton Flats were not economically justified at the time.



Big Lost River

MudLake



VICINITY MAP



north

Mud Lake

CHAPTER FIFTEEN

MudLake

The Mud Lake area is a closed basin on Camas Creek, 20 miles west and 50 miles north of Idaho Falls in Jefferson County, Idaho. The lake is formed by a 10-mile-long embankment constructed many years ago by local farmers to confine the lake and make it possible to farm the land and provide water elevation so that irrigation canals could deliver water to farms. The capacity of the lake is 45,000 acre-feet. The embankment protects farmland which was improved by leveling and drainage and developed with homes, farm buildings, private and county roads, and local businesses. Over 20,000 acres of cropland are irrigated with water from the lake. The area is a major supplier of livestock feed for Idaho, Montana, and other states.

A flood emergency channel, an extension of the Owsley Canal, can serve as an outlet for Mud Lake but is dependent upon the canal company lift pumps. In past years, the lake has risen to dangerous levels due to above-average inflow to the basin. This resulted in prolonged flood-fight activities by the locals, the State, and the Corps. Even with substantial flood fight efforts, the existing embankment nearly failed in the spring of 1984 when the water level reached a gauge height of 10.7 feet.

Previous studies by the Corps indicated that extensive improvement of the embankments to Corps design standards was not economically feasible. Thus, the solution to the flood problem appears to involve interception of flows above the lake and seepage of those waters into the ground or to pump water from the lake into an enlarged Owsley Canal or the Jefferson Canal.

The reconnaissance study determined that four alternatives have benefit-to-cost ratios that exceed unity. The four alternatives are:

(1) Wildlife Refuge Enlargement. The area north of Camas Creek between the State and Federal wildlife refuges is flooded during high runoff years. This alternative considers the possibility of purchasing or leasing this land and constructing a dike along the county road on the south side of this area. This area could store approximately 22,000 acre-feet of floodwaters, when needed, and also could be managed to provide wildlife and irrigation benefits.

(2) Jefferson Canal Diversion Pond. Additional pumps installed in Mud Lake could be used to transport water from the lake to a disposal area west of the lake on Idaho National Engineering Laboratory land via the

existing Jefferson Canal. A dike would be required around the disposal area to prevent flooding of adjacent cropland, and a canal would be needed from Mud Lake to the pump site to ensure water availability to the pumps when the gauge height reaches 8 feet.

(3) Lone Tree Dam. About 1920, a dam was built on Camas Creek upstream of Mud Lake to store irrigation water. The reservoir would not hold water due to fractures or lava tubes in the basalt under the reservoir, and the dam was breached in 1924. If the dam were rebuilt, water could be impounded during high runoff years and allowed to percolate into the groundwater table.

(4) Western Diversion. In 1969, under "Operation Foresight," the Corps constructed a diversion from Camas Creek, just above the old Lone Tree Reservoir, along a former irrigation ditch to the east of Camas Creek. This diversion infiltrates approximately 500 cubic feet per second into the basalt formation, which eventually returns to Camas Creek as groundwater inflow. It is proposed to construct a similar diversion to the west of Camas Creek, at the same diversion point, that could divert an additional 500 cubic feet per second.

A meeting was held on February 1, 1990, with the Mud Lake water users and the Jefferson Soil and Water Conservation District on the subject of project sponsorship. Considerable interest in a project was expressed by the local people, particularly concerning the Lone Tree Dam alternative. However, they asked to delay further study until a groundwater study was completed by the U.S. Geological Survey. Subsequent to this request, the sponsor has not responded favorably to resuming the study due to financial concerns. Currently, there is no activity towards renewing this study.

Portneuf River Basin



CHAPTER SIXTEEN

Portneuf River Basin

Pocatello Levees and Channel Improvements

This project includes removal of obstructions and channel improvements at Pocatello, Blackrock, and Inkom on the Portneuf River, and along Marsh Creek.

Construction of the Pocatello unit was completed in 1968 at a Federal cost of \$6,456,000 and an estimated non-Federal cost of \$482,000 for rights-of-way, two new bridges, and relocation of utilities. More than \$2,184,000 in flood damages have been prevented by the project through 1995.

A five-year limitation on project authorization ended on October 14, 1969, for the Inkom-Marsh Creek unit of the project. Thus, that portion of the project is no longer authorized.

Snagging and Clearing of Rapid Creek through Inkom

A contract was awarded in 1985 to deepen Rapid Creek to accommodate larger stream flows.

Basin Survey

The study of Portneuf River Basin to determine needs for flood control and related improvements was requested by resolution of the House of Representatives Public Works Committee in 1964. Interest in flood protection became active due to record floods in 1962 and 1963. Damages from erosion and siltation were severe throughout the basin. The Bannock County Commissioners and Pocatello Chamber of Commerce, as well as numerous individuals, requested investigations of multipurpose storage projects and an organized land treatment program.

In 1969, a Corps report concluded that a dam on Marsh Creek, a tributary of the Portneuf River, would be economically feasible. However, more than one-half of the project benefits would have been for recreation. Projects with such a distribution of benefits have little likelihood of authorization by Congress. Thus, the study was suspended.

The Portneuf River Basin has been subject to significant growth, which might modify the economic



Portneuf River



Pocatello Channel

feasibility of a project. In 1986, the study was resumed as part of the Upper Snake River Basin Study. Major concerns in this study included basin flooding problems in the winter and spring, water shortages during the summer and fall, and poor water quality in Marsh Creek and in the Portneuf River below Lava Hot Springs. The 1986 study considered two alternative plans for diversion of Bear River water to Portneuf Basin and six alternatives without Bear River diversions. All of the alternatives included dams as part of the systems studied. None of the alternatives were determined to be economically feasible. The McCammon diversion and power plant was the closest to having economic justification with a benefit-to-cost ratio of 0.9 to 1. Benefits would be derived primarily from power generation. The Marsh Creek dam site alternative had a benefit-to-cost ratio of 0.8 to 1. In 1988, the current study conclusion reconfirmed the earlier study findings that a large part of the benefits for the project would be derived from recreation. The study also concluded that economic feasibility was lacking for the projects studied; consequently, the study was terminated.

Portneuf River Environmental Restoration Project

Section 1135 of the Water Resource Development Act of 1986 (Public Law 99-662) provides authority for modifying Corps projects to restore fish and wildlife habitat. These modifications are limited to \$5 million.

A Section 1135 project is being studied on the Portneuf

River at Pocatello. The Corps constructed a flood control project on the Portneuf through the city of Pocatello in the late 1960's. It consisted of straightening a 6.2-mile section of the river and construction of a 1.5-mile rectangular, concrete channel as well as a 4.7-mile revetted levee. The project resulted in the elimination of fish and wildlife habitat, including wetlands. Also, passage of trout and warm water game fish into City Creek, for spawning, was blocked.

Based on a cursory evaluation, it is estimated that 4.1 miles of river and 144 acres of riparian habitat have been lost as a result of the construction of this flood control project. The greatest amount of habitat was lost due to the concrete channel.

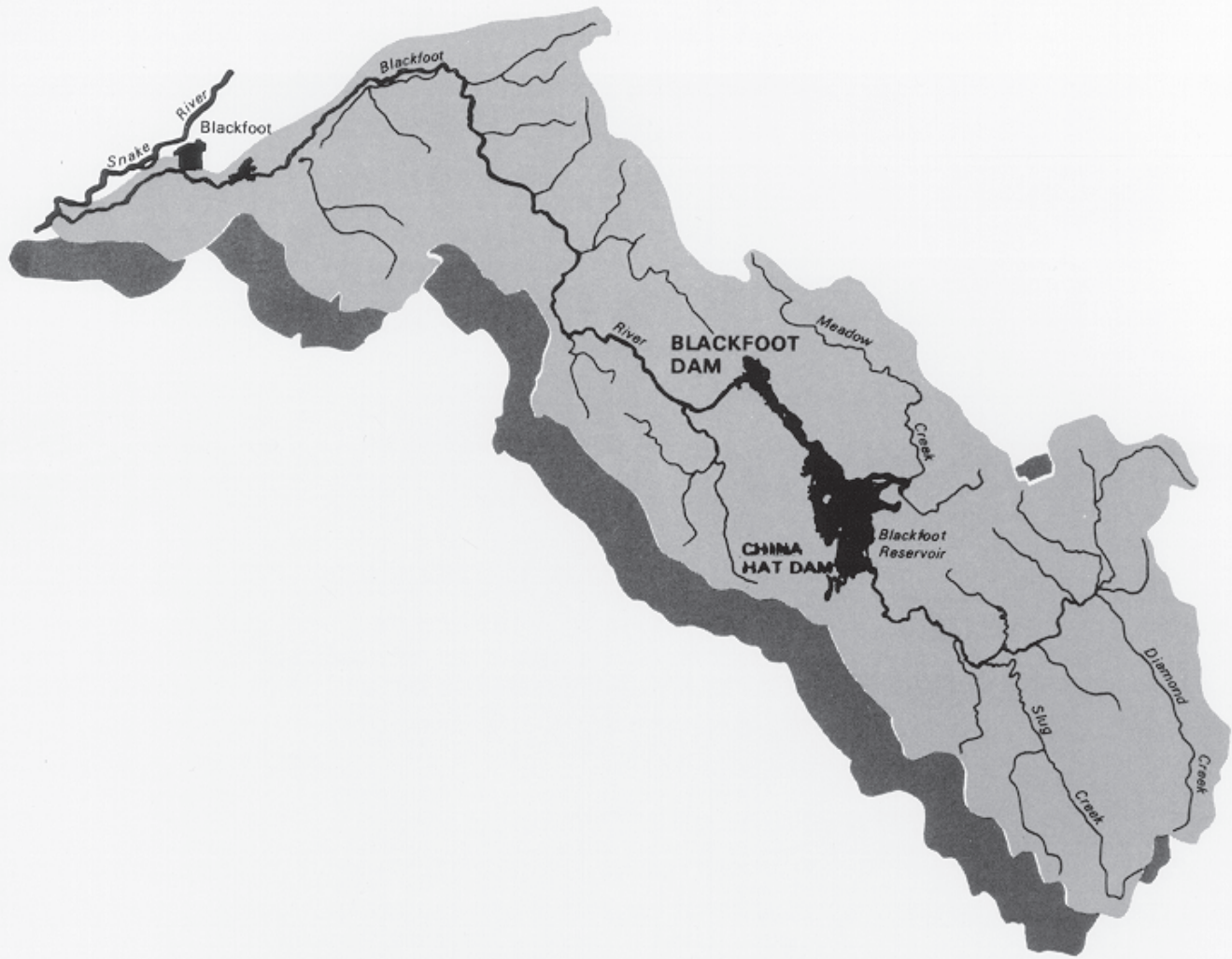
In an effort to restore fish habitat, low-flow channels would be provided. This would include modifying the existing concrete channel floor and in some areas constructing small secondary low-flow channels adjacent to the concrete channel. The modification of the entrance to City Creek to allow fish migration will also be investigated. In other areas, instream habitat improvements are proposed.

For the restoration of wildlife habitat, the Corps is investigating construction of side channels with the existing channel used to pass high flows. This would allow for the establishment of vegetation for riparian zones and some wetlands. Also being evaluated is widening and laying back side slopes of the non-concrete channel sections to allow habitat development.



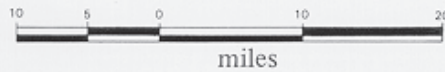
Pocatello Flood Control Project on Portneuf River

Blackfoot River Basin



vicinity map

Blackfoot River Basin



Blackfoot River Basin

Levees

The Blackfoot River flood protection project was authorized by the Flood Control Act of 1950. It includes channel improvements, levees, and replacement of inadequate and restrictive irrigation and bridge structures to prevent flood damages to part of the city of Blackfoot and irrigated agricultural lands. Construction was completed in 1964 at a Federal cost of \$391,000. Flood damages prevented by the project have amounted to \$870,000 through 1995.

Blackfoot Reservoir Modifications

Blackfoot Reservoir is on the Blackfoot River about 40 miles southeast of the city of Blackfoot. The project is owned and operated by the Bureau of Indian Affairs. It provides irrigation water to land on the Fort Hall Indian Reservation. The Flood Control Act of 1962 authorized the Corps to make modifications to the dam in order to incorporate flood control as a project function.

A General Design Memorandum was completed in 1969 proposing modifications to the spillway and outlet works at Blackfoot Dam, raising the operating pool elevation, and likewise raising the upstream China Hat Dam 10 feet. By 1974, intense local opposition developed

as it became evident that the higher operating pools proposed in the dam modification plans would inundate recently constructed summer homes in the area. The local sponsor then withdrew support for the modifications.

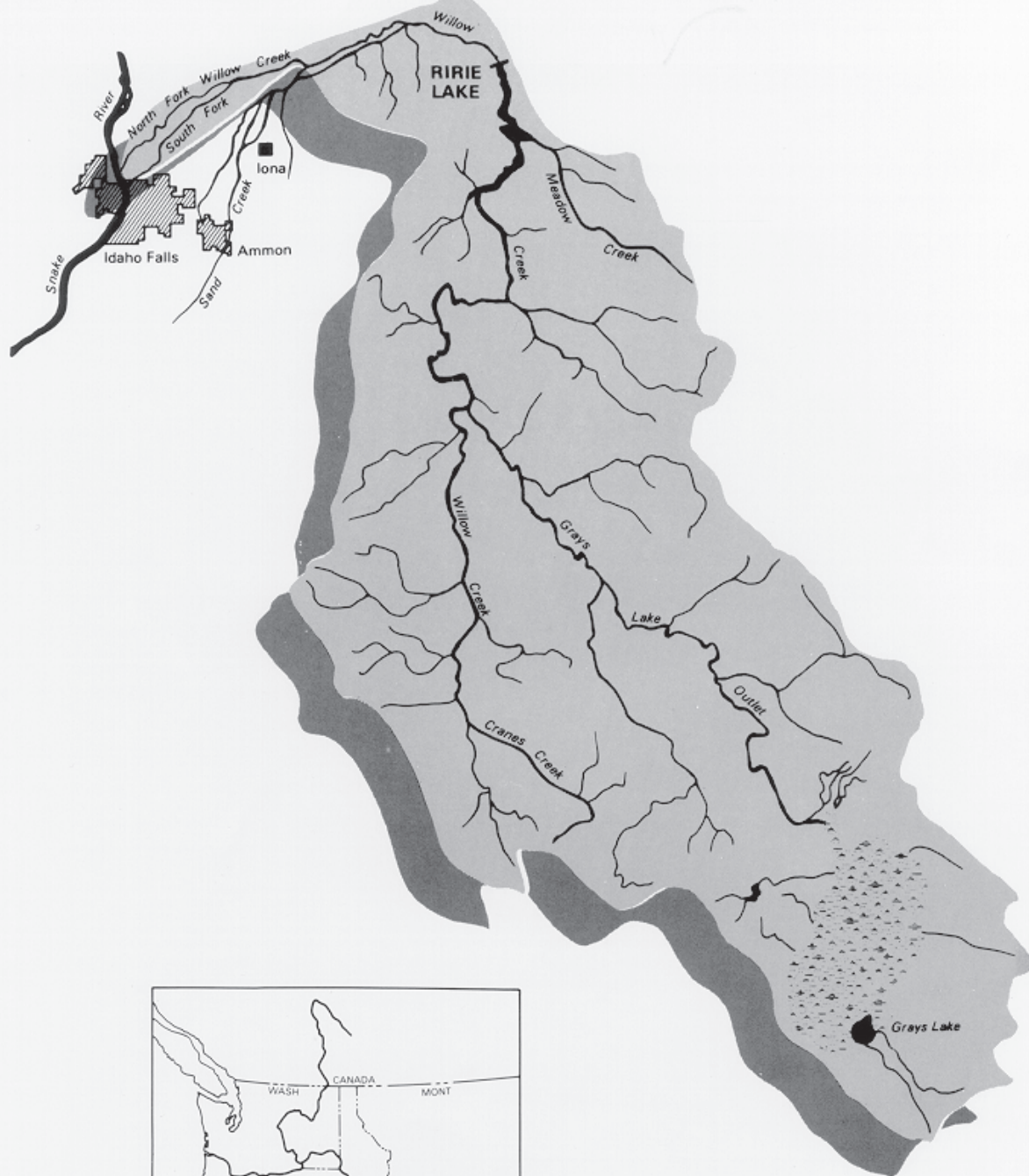
The Corps subsequently revised the modification plans and, in a 1978 report, proposed that the spillway and outlet be reconstructed so the normal operating pool could be maintained at its historic level. The reconstruction would still serve the need to improve dam safety, but new flood control capability would be reduced. China Hat Dam would be raised 2 feet instead of the previously planned 10 feet. These proposals gained public acceptance from the concerned agencies and private groups. However, approval to go ahead with construction was disapproved by Corps higher authority since the modifications were essentially a correction for dam safety rather than flood control as authorized.

The Bureau of Indian Affairs then pursued funding on its own, and the Corps agreed to accept the Bureau of Indian Affairs' request to design and construct the proposed modifications. Construction work began in 1986 and was completed in 1986 at a cost of \$7.4 million. The authority to make future modifications primarily to benefit flood control was withdrawn by the Water Resources Development Act of 1986 (Public Law 99-662).



Blackfoot Reservoir

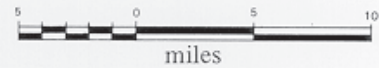
Willow Creek Basin



vicinity map



north



Willow Creek Basin

CHAPTER EIGHTEEN

Willow Creek Basin

Ririe Dam and Lake

The Ririe project is on Willow Creek in southeast Idaho, about 3 miles southeast of the town of Ririe. The project was initially recommended in the 1961 Upper Snake River Basin Report. Formal authorization was provided by the Flood Control Act of 1962. The authorization included construction of the dam and construction of channel improvements on Willow Creek from the dam downstream to the Snake River confluence. The Corps was responsible for the project design and construction. Construction began in 1967, and the reservoir was filled in 1975. Project operation was then transferred to the Bureau of Reclamation in 1976. Construction contracts for the downstream channel work, recreational facilities, and miscellaneous deficiencies were completed in 1980.

The dam is a 253-foot rockfill structure with a crest length of 1,070 feet. It is equipped with an outlet conduit discharging into the natural Willow Creek channel. From the dam, Willow Creek carries the discharge water about 14 miles to collection and diversion works. Water necessary for irrigation needs is diverted to the Sand Creek and the natural Willow Creek drainages. Excess floodwaters are conveyed down a separate man-made channel directly west from the diversion works for 7.8 miles and discharged into the Snake River.

At maximum full pool, Ririe Dam creates a reservoir extending about 12 miles upstream on the main stem of Willow Creek with a shoreline of about 32 miles and a surface area of 360 acres. The total storage capacity is 100,500 acre-feet. Of this total, 80,500 acre-feet is assigned to the joint use of flood control and irrigation, and 10,000 acre-feet is assigned to exclusive flood control space. The remaining capacity is dead or inactive space used as a conservation pool.

During the winter and spring runoff, the active capacity is used primarily for flood control regulation. The project provides flood protection to Idaho Falls, Iona, Ammon, and surrounding farmlands. Flood control procedures are incorporated into the project Water Control Manual. It is the intent of the flood control regulations to restrict reservoir releases to a maximum of 1,900 cubic feet per second, preferably 1,200 cubic feet per second, during all but the largest of floods.

Once the danger of spring runoff flooding is past, the 80,500 acre-feet of joint use space in the reservoir is filled for irrigation storage. The remaining 10,000 acre-feet of active capacity is retained as exclusive flood control space for control of flash floods.

Other authorized uses include recreation, fish and wildlife mitigation, and minimum streamflow maintenance. Recreation activities include an access road and five designated recreation areas. The pool is annually stocked with fish. Remaining project lands are managed as wildlife and waterfowl mitigation areas. Minimum streamflows are maintained downstream of the dam except when icing may block the channels.

Construction costs through 1988 were \$39,677,449. Flood damages prevented since spring 1975 are estimated to exceed \$5,528,000 through 1995.

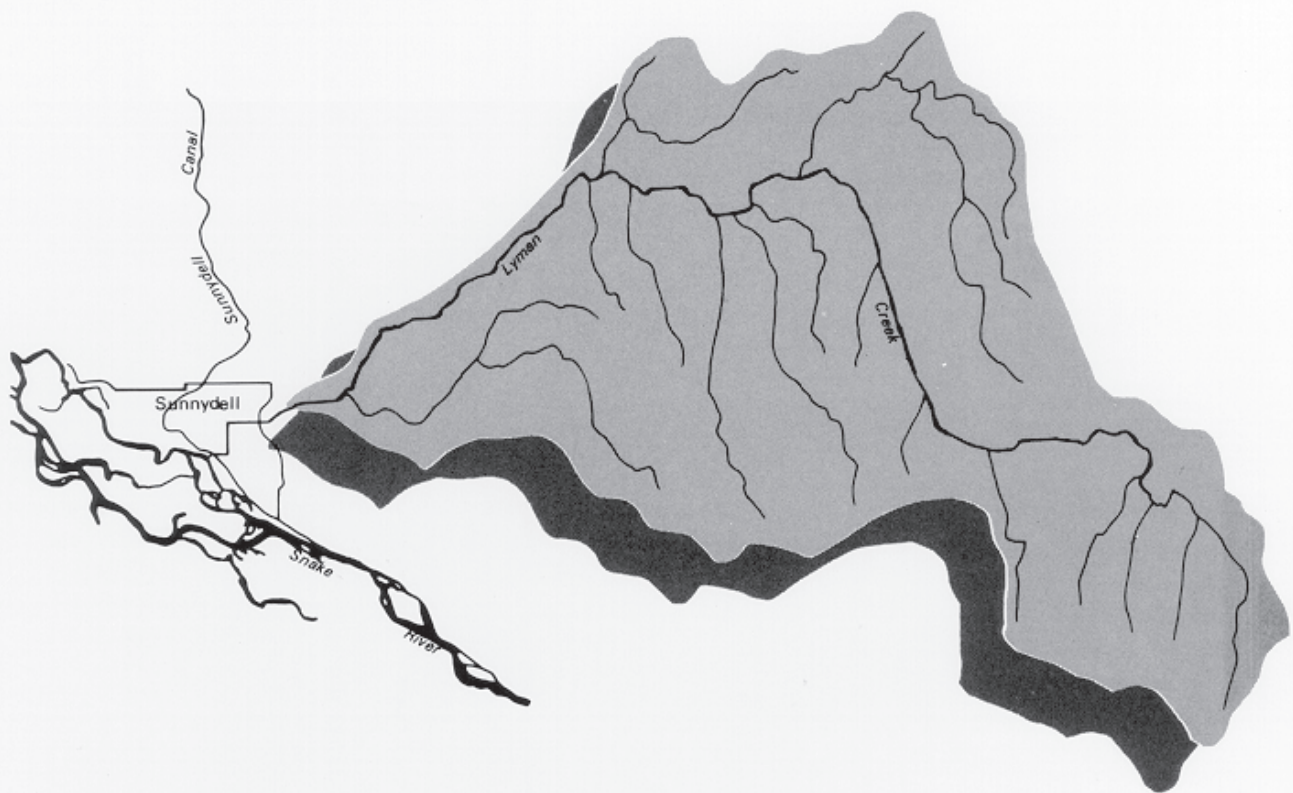
Basin Survey

A basin survey study was authorized by resolutions of the U.S. Senate Committee on Public Works and the U.S. House of Representatives Public Works Committee. The study will assess water resource needs and problems in the Willow Creek-Sand Creek-Blackfoot River area and will evaluate means of satisfying those needs. A primary objective is investigation of flood damage reduction along Sand Creek. The survey will begin when funds are appropriated.



Ririe Dam

Lyman Creek Basin



vicinity map

Lyman Creek Basin

CHAPTER NINETEEN

Lyman Creek Basin

Levees

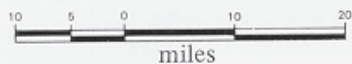
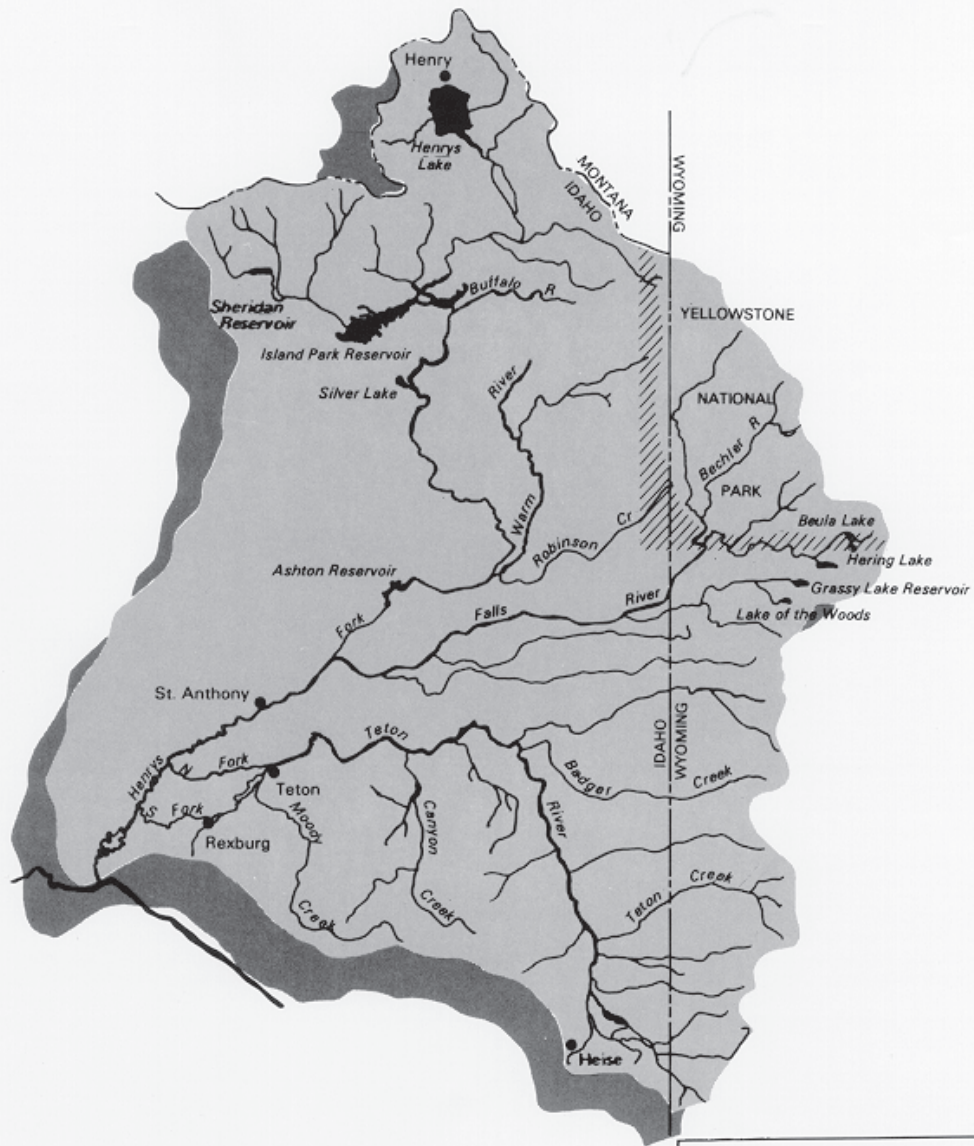
Channel and levee works divert Lyman Creek flows to the Snake River to prevent flooding of farms, homes, irrigation canals, buildings, roads, and bridges. The

project, authorized under Section 205 of Public Law 858, as amended, was completed in 1971 at an estimated Federal cost of \$230,000. Damages prevented by the project are unavailable since the gauge has been discontinued.

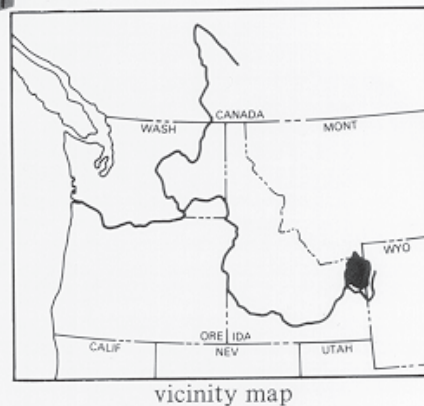


Lyman Creek

Henrys Fork River Basin



Henrys Fork River Basin



vicinity map

CHAPTER TWENTY

Henrys Fork River Basin

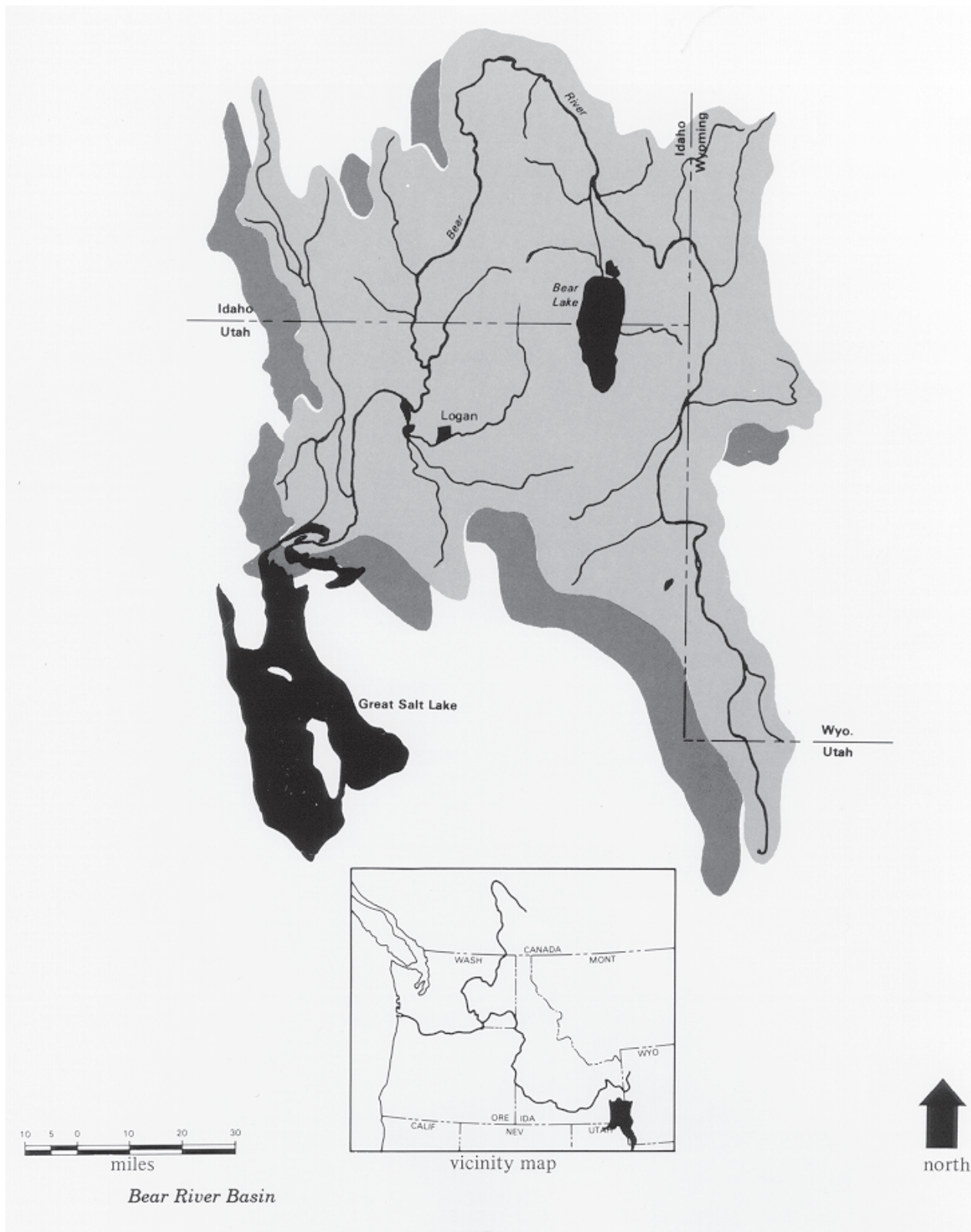
A survey study of Henrys Fork River Basin was authorized by a resolution of the U.S. House of Representatives Public Works Committee. Flood control, irrigation, and recreation are principal needs in the basin. The study was initiated, but suspended, due to lack of funds. It cannot be completed until additional funds have been appropriated.

Channel improvements, levees, and revetments along 10 miles of the Teton River from its mouth below Rexburg to the canyon reach above the town of Teton were authorized, but the proposed structural work is not economically feasible. The project was deauthorized by the Water Resources Development Act of 1986 (Public Law 99-662).



Henrys Fork River Basin

Bear River Basin



CHAPTER TWENTY-ONE

Bear River Basin

Basin Survey (Sacramento District)

A survey study of the Bear River Basin in Idaho, Utah, and Wyoming was authorized in 1938 to develop a program for preventing flood damage, providing additional water supply, and alleviating drainage problems. The study was started in 1947 but was suspended in 1951 pending completion of Bureau of Reclamation studies of water resources and is presently inactive. A general

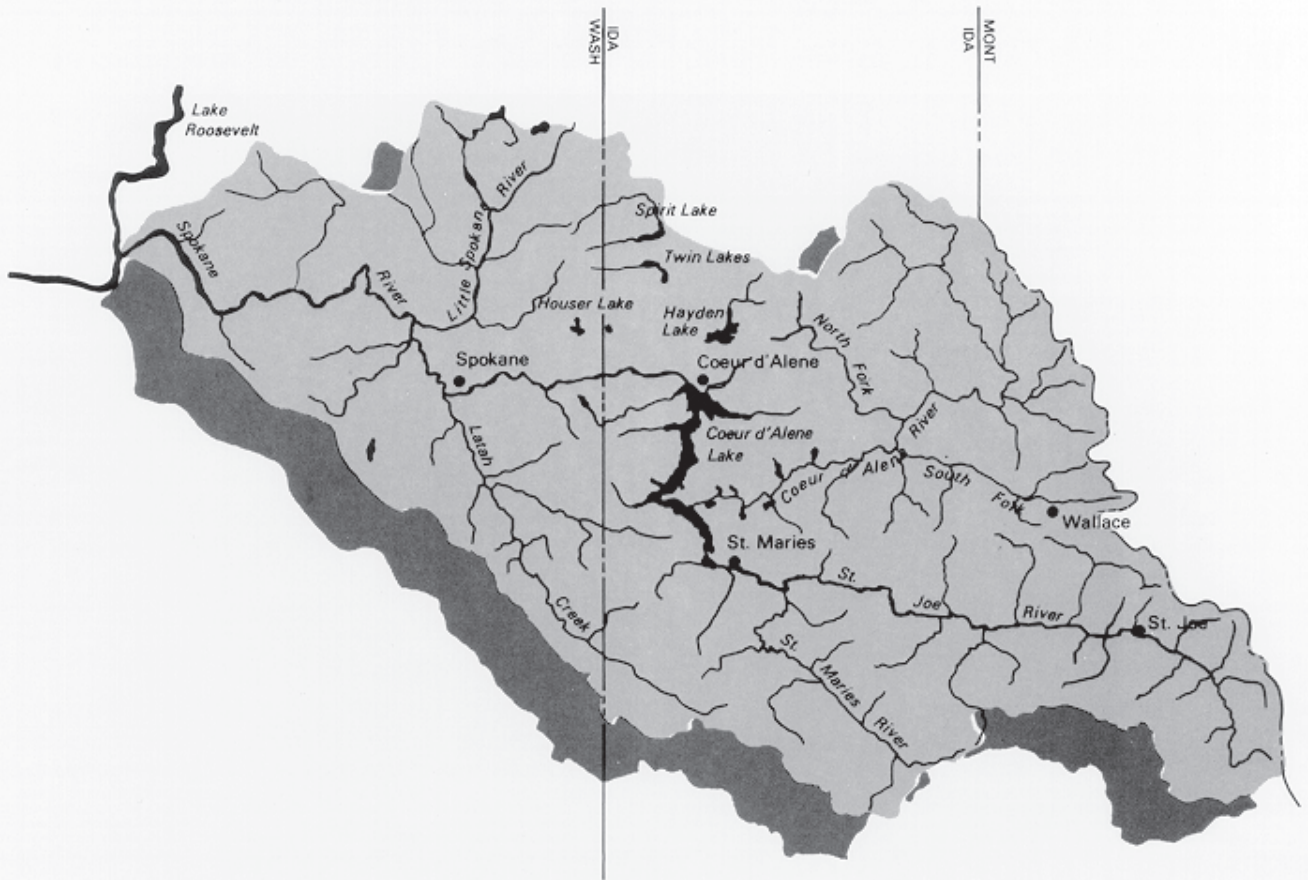
investigation study was completed by Sacramento District in March 1989 in conjunction with associated studies by the states of Idaho, Wyoming, and Utah.

The conclusion of the study was that a reservoir project on the Bear River near Oneida Narrows, Idaho, did not meet Corps criteria for agricultural water supply and flood control. No further studies were recommended.



Bear Lake (photo courtesy of Utah Travel Council)

Spokane River Basin



vicinity map

Spokane River Basin



CHAPTER TWENTY-TWO

Spokane River Basin

The Spokane River Basin is in northern Idaho and eastern Washington. Principal tributaries of this 6,640-square-mile basin are the St. Joe and Coeur d'Alene Rivers, flowing into Coeur d'Alene Lake. The Spokane River, outlet for the lake, flows westerly for 100 miles to Franklin D. Roosevelt Lake on the Columbia River. Above Coeur d'Alene Lake, the basin is a mountainous, forested region. Below the lake, the Spokane River occupies a deep valley along the edge of a rolling plateau with little forest cover. The major portion of the floodplain is agricultural land.

Coeur d'Alene Lake (Seattle District)

This project includes a system of levees and flood walls on the Spokane River and Coeur d'Alene Lake to protect a portion of the city of Coeur d'Alene from frequent floods. The project was completed in 1941. Federal costs totaled \$152,872.

St. Maries, St. Joe River (Seattle District)

This project provides for levees and flood walls at the town of St. Maries. It extends downstream below the Potlatch Lumber Company. The project was completed in 1942 at a Federal cost of \$357,700. Damages prevented by this work through fiscal year 1995 were estimated at \$3,222,000.

Under the Columbia River and Tributaries Study, the feasibility of a multipurpose project in the St. Maries-St. Joe Basin and local flood damage reduction projects near the city of St. Maries were investigated in 1987 and 1988. No feasible alternative acceptable to the State of Idaho has been identified.

Spokane River and Tributaries, Idaho and Washington (Seattle District)

In 1965 and 1966, both the Senate and House of Representatives requested a review of reports to determine the advisability of improvements for flood control and other purposes along the Spokane River and its tributaries. Water resource problems and needs include

flood control, water quality, navigation, irrigation, recreation, and fish and wildlife enhancement. Reconnaissance studies indicated that flood control improvement projects along Hangman (Latah) Creek, near Tenseo; navigation measures on the St. Joe River; a multipurpose storage site at Enaville on the Coeur d'Alene River; and improvement of the Coeur d'Alene Lake outlet were not economically feasible.

In 1973, the study was expanded to place emphasis on urban problems in the metropolitan Spokane area and to include study of runoff and flood control, water supply, regional water quality, wastewater management alternatives, and related water resource needs. The urban study was completed in 1976 and transmitted to Congress in 1978. The report provided the Spokane area with a long-range plan for water resources management along with recommendations for sewage sludge management, flood damage prevention, urban runoff, and protection of the area's water supply resources.

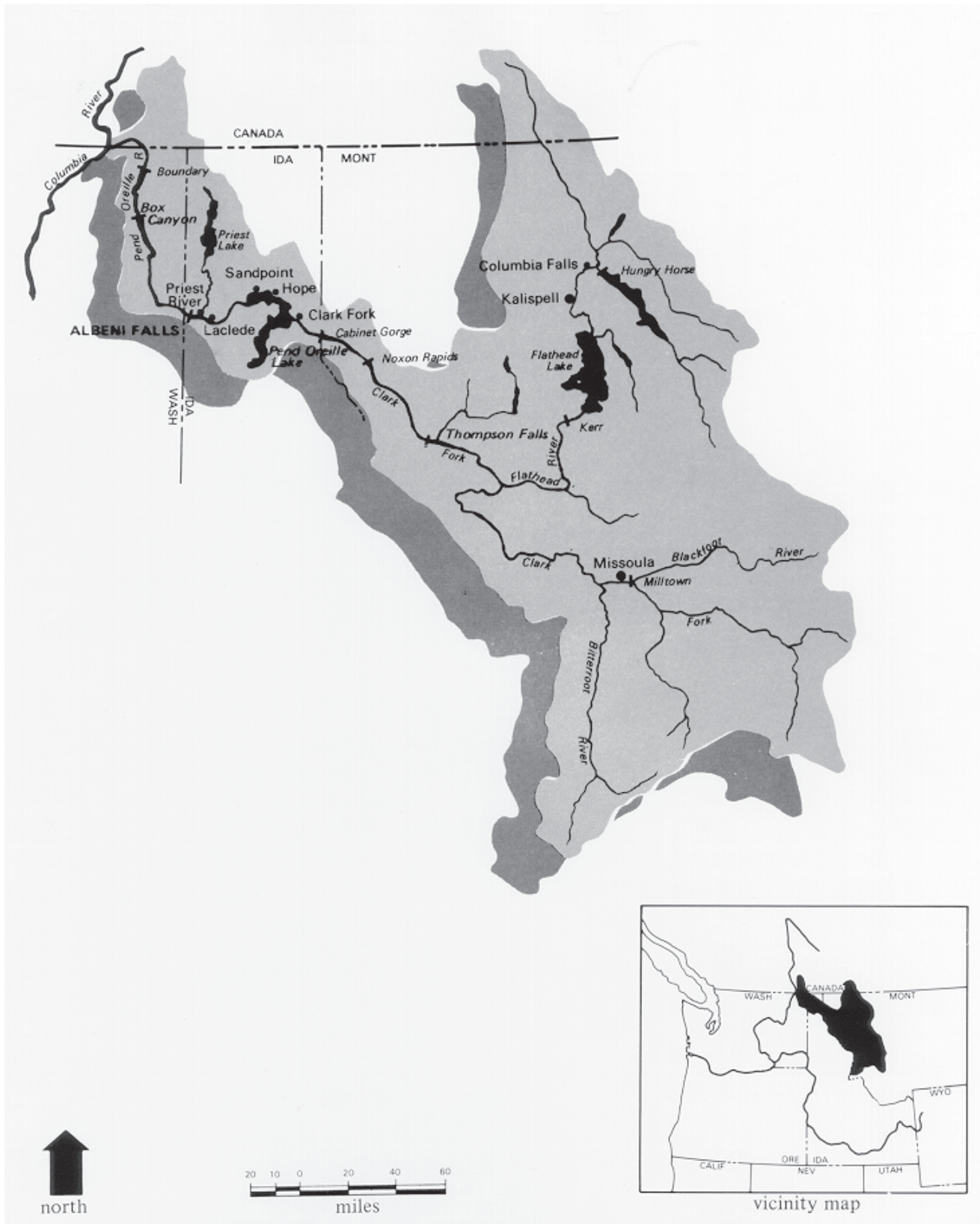
Placer Creek (Seattle District)

Debris-laden floodwaters from Placer Creek at Wallace have periodically caused heavy damage to the city and suburbs.

In 1968, the Corps recommended construction of a 5,000-foot-long flood control channel through Wallace to the south fork of the Coeur d'Alene River and a debris basin at the upstream end of the channel.

Construction of the project was completed in 1983, at a cost of \$5,865,000. The project included 3,700 feet of reinforced concrete channel with a 560-foot-long debris basin at the upstream end. Shoshone County and the city of Wallace were local sponsors. Flood damages prevented through fiscal year 1995 totaled \$1,566,000.

Pend Oreille River Basin



CHAPTER TWENTY-THREE

Pend Oreille River Basin

Albeni Falls Dam (Seattle District)

This multipurpose project is on the Pend Oreille River between Priest River, Idaho, and Newport, Washington. Major purposes of the project are power generation and regulation of streamflow for downstream hydroelectric projects. Navigation, flood control, conservation, and recreation are other important project purposes.

Construction of Albeni Falls Dam began in 1951. The spillway and upstream cofferdam for the powerhouse were completed for regulation of Lake Pend Oreille in June 1952. The three generators were placed in operation in 1955. The dam and reservoir are operated to control release of water in close coordination with other hydropower plants on the Clark Fork-Pend Oreille-Columbia River system.

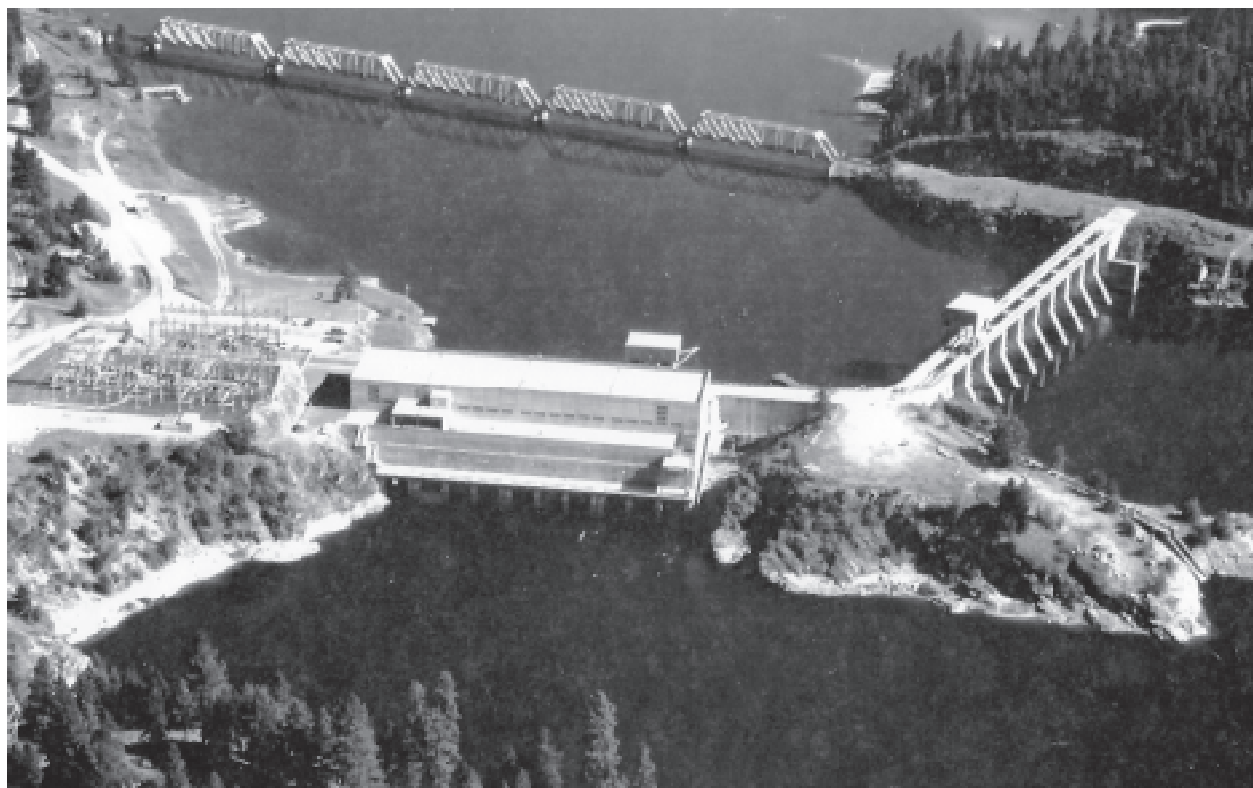
Storage releases from the Albeni Falls reservoir aid navigation on the lower Columbia River by maintaining

higher river stages during the low-water season. The project also provides recreation and flood control.

The project includes a low concrete gravity dam, a gated spillway, and a powerhouse with an installed generating capacity of 42,600 kilowatts. The reservoir, consisting of the upper reach of Pend Oreille River, all of Lake Pend Oreille, the lower reaches of the Clark Fork, and several smaller tributary streams, has a usable storage capacity of 1,153,000 acre-feet. Total Federal costs through 1995 were \$31,741,561, which includes \$137,000 in Public Works Acceleration Act funds and \$971,947 for recreation facilities at completed projects.

Through fiscal year 1995, an estimated \$9,116,000 in flood damages have been prevented by Albeni Falls Dam.

Power generation at Albeni Falls Dam for 1995 was 215,781 megawatt hours. Revenue from the sale of power by the Bonneville Power Administration generated at the project in 1995 was \$3,090,050. A portion of power revenues are returned to the U.S. Treasury to repay the



Albeni Falls Dam

interest and principal on construction costs and to pay power related to operation and maintenance costs.

Recreation

Recreation areas developed by the Corps at Albeni Falls Dam/Lake Pend Oreille include a Vista Area at the dam site, four fully developed campgrounds with associated day-use facilities, one day-use-only area, and several sites which provide access to the water and/or primitive camping. Campgrounds, and their day-use components, are generally open from mid-May through mid-September. The Vista Area at the dam will be open year-round starting in the fall of 1996. Other access points and the Trestle Creek day use area remain open throughout the year with access limited only by snowfall.

The Vista Area at Albeni Falls Dam is located 2 miles east of the Washington/Idaho border on U.S. Highway 2. A new visitor center was constructed here in late 1995 and will be fully operational for the 1996 recreation season. The building houses interpretive exhibits, accessible rest rooms, and is the starting point for tours of the dam during the summer months. Picnic facilities are located on the grounds surrounding the center.

Four fully developed areas built and operated by the Corps provide a variety of recreation opportunities including camping, picnicking, swimming, boat launch ramps and trailer parking, drinking water, and rest rooms. Priest River, Riley Creek, and Springy Point recreation areas provide hot showers and Recreation Vehicle dump stations, and Priest River and Riley Creek have picnic shelters and playgrounds located in the day-use portions of the park. Albeni Cove Recreation Area is located 2 miles east of the city of Oldtown, Idaho, on the south shore of the reservoir. Priest River Recreation Area is located 1 mile east of the City of Priest River, Idaho, on U.S. Highway 2. Riley Creek Recreation Area is located near the town of Laclede, Idaho, about half way between Priest River and Sandpoint on U.S. Highway 2. Access is by county road. Springy Point Recreation Area is located on Lakeshore Drive approximately 1 mile south of Sandpoint and 3 miles west of U.S. Highway 95. Strong's Island, located 2 miles upstream of the dam, was operated as a boat access and picnic/primitive camp area until the spring of 1981 when it was closed to reduce recreation operating costs.

Trestle Creek Recreation Area, located near the city of Hope, Idaho, along State Highway 200, is a small day-use area which provides a boat launch ramp and parking area, picnic area, swim beach, and vault rest rooms.

Other public facilities and access points are located on Corps lands licensed to the State of Idaho, Department of Fish and Game. Morton Slough is located off of the Dufort Road, approximately 9 miles west of

U.S. Highway 95. This area provides a boat launch ramp, parking area, and vault rest room. Overnight camping is allowed at the site. Johnson Creek is located approximately 3 miles southwest of the city of Clark Fork, Idaho, off the Johnson Creek county road. This area also provides boat launch ramps, parking, vault rest rooms, and areas for overnight camping.

Public launch ramps are also provided by the Corps or State of Idaho at the Corps' Drift Yard, located about 3 miles west of Clark Fork on State Highway 200 and at the mouth of the Pack River, off the Sunnyside Road, about 10 miles east of Sandpoint.

Clark Fork, Lightning Creek (Seattle District)

The Flood Control Act of 1950 authorized construction of a 4,000-foot-long levee on the left bank of Lightning Creek near its mouth to prevent flooding of the town of Clark Fork. The project was completed in 1959 at a federal cost of \$42,730 and turned over to the town for maintenance. Flood damages prevented through fiscal year 1995 were estimated at \$350,000.

Clark Fork - Flathead River Basin (Seattle District)

The Clark Fork and Flathead River Basin, including the Pend Oreille River Basin, covers an area of approximately 26,000 square miles in western Montana, northern Idaho, northeastern Washington, and southern British Columbia. Its headwaters originate along the Continental Divide from about 80 miles inside Canada, south to the juncture of the Idaho state line with the Continental Divide. Principal tributaries of the Clark Fork are the Flathead River in the northeast and the Blackfoot and Bitterroot Rivers in the east and south. The drainage area is generally mountainous and heavily timbered. Some agricultural development exists in the valleys. Resolutions adopted by the Senate and House of Representatives Public Works Committees authorized a study to determine if any modifications of existing projects or recommended comprehensive plans of improvements should be made.

The principal flood problems in the basin lie along the upper Flathead River. As a result of public planning efforts begun in 1968, a report was completed in 1974, recommending levees for the suburban areas of Evergreen and Day Acres, near Kalispell, and floodplain zoning for the remainder of the upper Flathead Basin. Advance engineering and design studies were initiated in 1978 but were discontinued in 1981 due to lack of local sponsorship.

A study completed in 1979 evaluated six potential hydropower sites on the lower Flathead (below Flathead

Lake) and Clark Fork Rivers and flood damage reduction measures along the Swan River. The hydropower study was completed in December 1979 with the conclusion that no further consideration was warranted because of foundation conditions at the dam sites. A project consisting of a system of levees and floodwalls along the Clark Fork River at Missoula was completed in 1980. Flood damages prevented through fiscal year 1995 totaled \$2,878,000.

From studies on the lower Flathead River, it was concluded that no further consideration of hydropower development on the Flathead River was warranted.

Planning Assistance to the State of Idaho: Priest Lake Outlet Structure Study

The Idaho Department of Water Resources requested that the Corps, under the authority of Section 22 of the 1974 Water Resources Development Act, conduct an evaluation of various summer and early fall operating

alternatives for the Priest Lake outlet structure in Bonner County, Idaho.

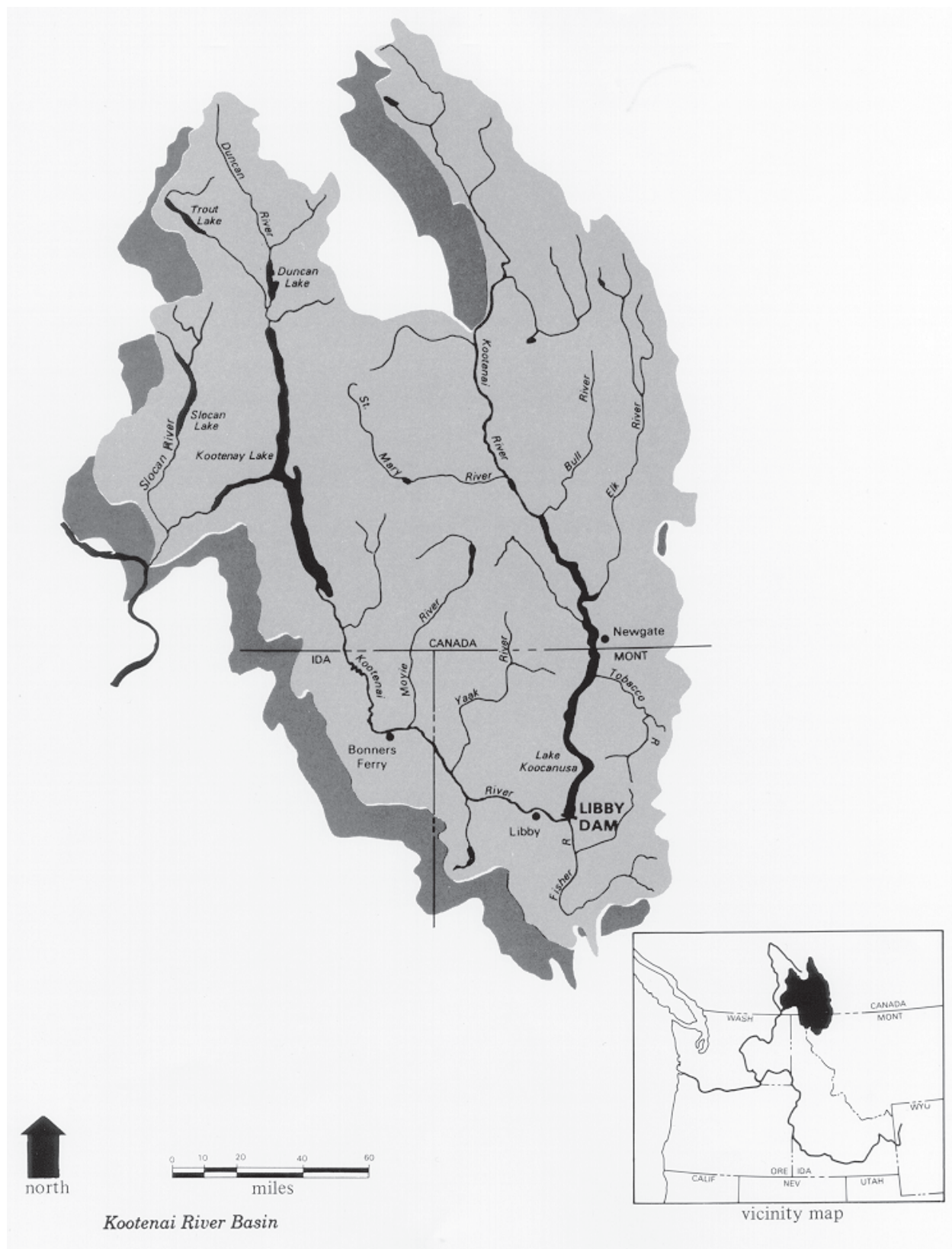
The objective of Idaho Department of Water Resources was to define an operation which more closely optimized all current and potential lake and river uses. The primary uses or concerns which the Corps evaluated included: hydropower, river recreation, lake property-owner concerns and recreation, as well as fish habitat in Priest River.

The Idaho Department of Water Resources and the Corps chose three outlet structure operation alternatives for the Corps to investigate. The Corps study was completed in November 1992. The Corps' report concluded that all three operation alternatives increased and stabilized flows in the river during the late summer and early fall periods. In terms of operational feasibility, the flow and lake level objectives would have been most often met by alternative one, which would have kept the outlet flow between 200 cubic feet per second and 1,000 cubic feet per second from July to the end of October. It did not appear that alternative one would have adversely impacted the lakeshore residents.



Lake Pend Oreille

Kootenai River Basin



CHAPTER TWENTY-FOUR

Kootenai River Basin

Kootenai River Drainage (Seattle District)

The Kootenai River drainage basin is in southeastern British Columbia, northwestern Montana, and northern Idaho. The Kootenai River is primarily a Canadian stream with three-fourths of its drainage area and two-thirds of its length in British Columbia. From the standpoint of total basin area, the Kootenai is the third largest tributary of the Columbia, draining an area of 19,300 square miles. The major tributaries of the Kootenai River are the St. Mary, Bull Elk, Fisher, Yaak, Moyie, and Slocan Rivers.

The Kootenai Basin is largely mountainous and dominated by three major ranges. The Rocky Mountain Range and its offshoot, the Flathead Range, constitute the eastern boundary; the Purcell Range roughly bisects it from north to south. The Selkirk and Cabinet ranges mark the western boundary. Elevations reach a maximum of

about 12,000 feet with most summit elevations between 6,000 and 7,500 feet. Except for a few areas, the entire watershed is heavily forested.

The only extensive areas adaptable to agriculture without clearing are along Tobacco River and the broad floodplain of the Kootenai, extending north from Bonners Ferry, Idaho, to Kootenai Lake, British Columbia. This floodplain is the most important agricultural area in the basin. It consists of about 73,000 acres of fertile, deep alluvial soil, about 50,000 acres of which are protected from high waters by levees.

Non-Federal levee systems, constructed in the United States section of the Kootenai Flats and the lowlands along the Kootenai River, protect 34,437 acres of land, including 190 acres in the urban community of Bonners Ferry, Idaho. Leveed areas in the flats are vulnerable to damage from river action and seepage during high river stages.



Flooding of the Kootenai River

Completion of Libby Dam in June 1973 eliminated frequent flooding problems by the Kootenai River in this area of northern Idaho, as well as in areas of Montana and British Columbia. Through fiscal year 1995, an estimated \$56,599,000 in flood damages have been prevented by Libby Dam, a large multipurpose project on the Kootenai River, 14 miles east of Libby, Montana.

In 1976, construction began on four additional units at Libby Dam powerhouse and a re-regulating dam about 10 miles downstream from Libby Dam. However, a court decision found that the re-regulating dam was not authorized by Congress. Accordingly, all work on the re-regulating dam was terminated. However, since the courts decided that the four additional units at the Libby Dam powerhouse were authorized, their construction continued through September 1981. In the fiscal year 1982 appropriation, Congress limited further work to only one additional unit. Power from this unit was available in 1984.

Resource agencies, including the Corps, proposed a test program in June 1993 to develop data on white sturgeon spawning in the Kootenai River. Kootenai River white sturgeon were listed as an endangered species on October 6, 1994, by the U.S. Fish and Wildlife Service.

Libby Recreation Areas

Recreation areas developed by the Corps at Libby Dam and Lake Koocanusa include a visitor center at the dam site; day-use areas; and developed, primitive and boat access campgrounds. Souse Gulch, a day-use area with picnicking, trails, boat launch, boat moorage dock, water, and restrooms is on the west bank, just upstream from Libby Dam. Several dispersed recreation sites are downstream from the dam. Alexander Creek, Dunn Creek

Flats, and Blackwell Terrace offer boat access to the river, primitive camping, and excellent fishing. Souse Gulch, Alexander Creek, Dunn Creek Flats, and Blackwell Terrace are all operated by the Corps. Alexander and Blackwell have primitive boat access. Dunn Creek has the only improved launching ramp.

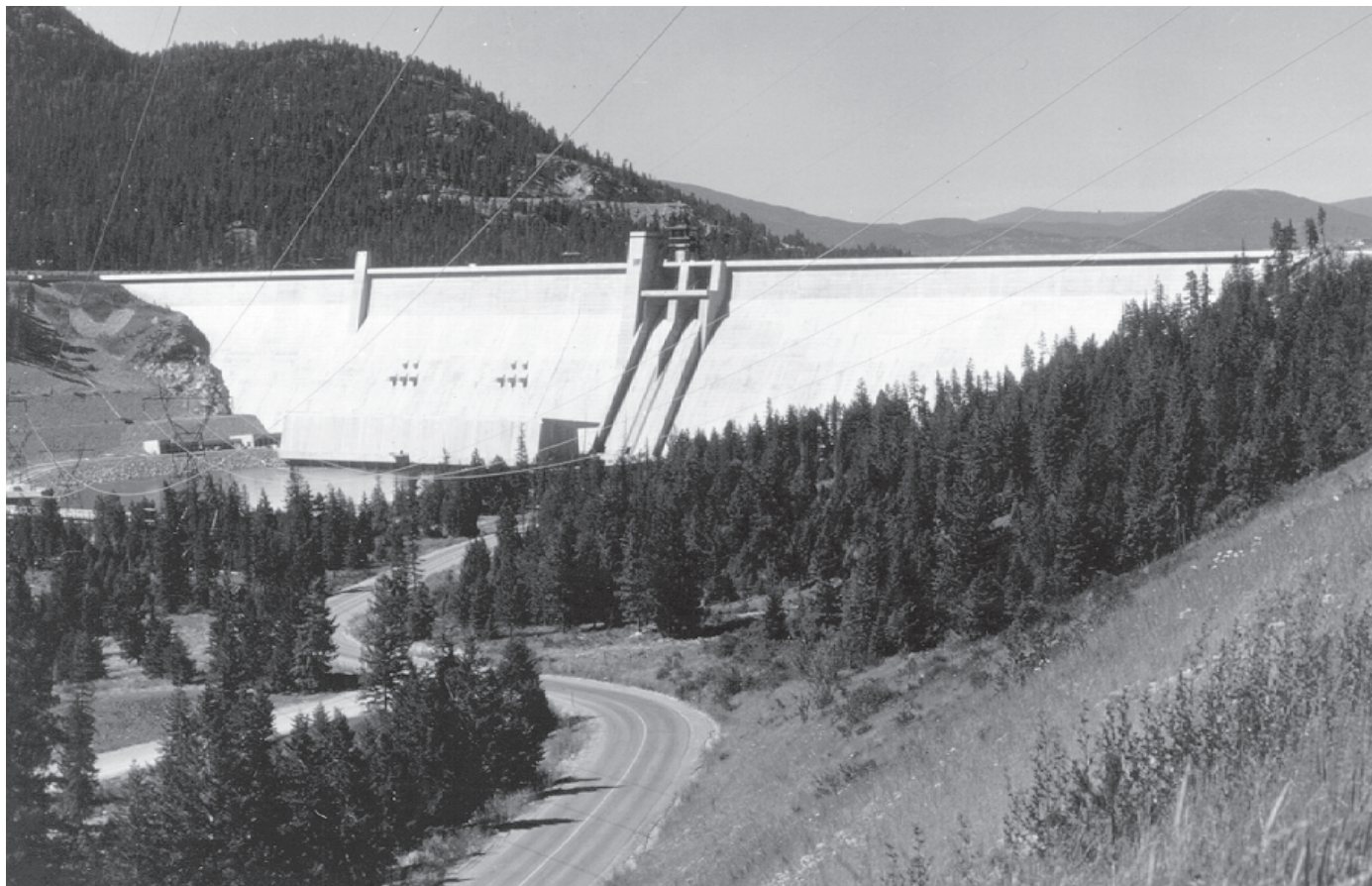
McGillivray Campground is 7.5 miles above the dam on the west shore and provides camping units, picnic shelters, a swimming beach, rest rooms, and a boat launching ramp. On the east shore, Cripple Horse Campground, 7 miles above Libby Dam, offers camping, marina, boat launching, and picnicking facilities. Peck Gulch is 29 miles upstream from the dam and offers a boat launch, picnicking, and waterfront camping. Rexford Bench, 44 miles upstream from the dam on the east shore, has a boat ramp, moorage, trailer dump station, swimming beach, picnicking, and camping. Yarnell Islands are 3 miles above the dam and offer boat access camping.

Tobacco Plains, 8 miles above the town of Rexford on the east shore of the lake, offers boat launching facilities and picnicking; Gateway, on the Canadian border, offers boat access camping only. Peck Gulch, Rexford Bench, Yarnell Islands, Tobacco Plains, and Gateway were developed by the Corps and are operated by the U.S. Forest Service. Cripple Horse Campground, jointly developed by private industry, the U.S. Forest Service, and the Corps, is operated by private industry.

In 1989, Libby Dam was designated by the State of Montana, Department of Fish, Wildlife, and Parks, as an official Watchable Wildlife Area. The area consists of the Downstream Natural Area and the David Thompson Bridge below the powerhouse. Viewing opportunities abound for deer, coyotes, river otter, moose, raccoons, bald eagles, great blue heron, geese, ducks, trumpeter swans, osprey, hawks, songbirds, and sea gulls.



Osprey-Lake Koocanusa



Libby Dam



Shoshone Falls

Independent Projects

Little Wood River

Little Wood River Reservoir is on the Little Wood River, about 9 miles north of Carey in south central Idaho. The dam is a 122-foot-high rolled earthfill structure with a crest length of approximately 3,100 feet.

A small hydropower generation plant with a 3,000-kilowatt capacity is installed in a bifurcation off the single concrete-lined outlet tube.

The lake behind the dam has a total capacity of 30,000 acre-feet, all of which is available for the joint use (active storage) of flood control, irrigation, and fish and wildlife habitat.

The project was constructed and is operated cooperatively by the Little Wood River Irrigation District and the Bureau of Reclamation. The initial construction was completed in 1941, after which the dam was raised to its current crest elevation in 1960.

The Corps is responsible for establishing flood control procedures for the Little Wood River project under Section 7 of the Flood Control Act of 1944. Regulation procedures are contained in the project Water Control Manual. It is the intent of the flood control regulations to restrict reservoir releases so that discharges at the Carey gauging station do not exceed 1,200 cubic feet per second during all but the largest floods.

Flood protection is provided along the Little Wood River from the project downstream below Carey to the Blaine-Lincoln county line. Only floods resulting from winter and spring runoff are controlled. At other times of the year, the reservoir is operated for irrigation.

In general, a conservation pool also is maintained for fish stocking purposes. Recreation facilities include two access roads, a campground, a picnic area, and a boat launching ramp. About 4,000 visitors use the facilities annually. Fishing is the major activity.

Swan Falls

Swan Falls, a power project on the Snake River at River Mile 465, is owned by the Idaho Power Company. The project has a power capacity of 10,265 kilowatts of electricity.

C. J. Strike

C. J. Strike, an Idaho Power Company project on the Snake River near Grandview at River Mile 492, was completed in 1952. The project has a power capacity of 83,000 kilowatts.

Bliss

Bliss, a power project on the Snake River near Bliss at River Mile 560, is owned by the Idaho Power Company. Completed in 1950, the project has a power capacity of 60,000 kilowatts.

Lower Salmon

Lower Salmon, an Idaho Power Company project on the Snake River near Hagerman at River Mile 573, was completed in 1949. The project has a power capacity of 60,000 kilowatts.

Upper Salmon

Upper Salmon, a power project on the Snake River about 9 miles upstream from the Lower Salmon Project, also is owned by the Idaho Power Company. The project produces 34,500 kilowatts.

Milner

Milner, an irrigation project at River Mile 640 on the Snake River, is jointly owned by the Twin Falls Canal Company and the North Side Company. In operation since 1905, the project has usable storage capacity of 80,000 acre-feet.

Minidoka

Minidoka is a Bureau of Reclamation project on the Snake River near Minidoka at River Mile 675. The project serves flood control, electric power and irrigation purposes. Completed in 1906, the project has usable storage of 210,000 acre-feet and power producing capacity of 13,400 kilowatts of electricity.

American Falls

The original dam was completed in 1927; but, because of deterioration, this Snake River project has been reconstructed with financing by the reservoir users and the Idaho Power Company. It is operated by the Bureau of Reclamation. Joint-use storage capacity is 1,700,000 acre-feet.

completed in 1969 by the Malad Valley Irrigation Company for flood control and irrigation. Total capacity of the project is 4,450 acre-feet, with 2,000 acre-feet of storage space reserved for flood control. The project provides flood protection for agricultural areas along Devil Creek, Malad River, and a portion of Malad City. It also helps prevent overtopping of Crowther Dam in Malad City.

Devil Creek

Devil Creek project on Devil Creek, a tributary of Malad River, 7 miles northeast of Malad City, was



Salmon River Headwaters

Glossary

Acre foot	A volume of water equivalent to one acre of land covered to a depth of one foot.
Advance engineering and design work	Work done by the U.S. Army Corps of Engineers in preparation of a project for construction.
Alluvial	Of, pertaining to, or composed of sediment deposited by flowing water, as in a riverbed, flood plain, or delta.
Appropriation	The setting aside of money by Congress, through legislation, for a specific use.
Authorization	House and Senate Public Works Committee resolutions or specific legislation which provides the legal basis for conducting studies or constructing projects. The money necessary for accomplishing the work is not a part of the authorization, but must come from an appropriation by Congress.
Bank and channel stabilization	The process of preventing bank erosion and channel degradation.
Basin	(1) Drainage area of a lake or stream, such as a river basin. (2) A naturally or artificially enclosed harbor for small craft, such as a yacht basin.
Breakwater	A wall built into the water to protect a shore area, harbor, anchorage, or basin from the action of waves.
Concrete-gravity structure	A type of concrete structure in which resistance to overturning is provided by its own weight.
Confluence	The place where streams meet.
Dam	A barrier constructed across a valley for impounding water or creating a reservoir.
Degree of protection	The amount of protection that a flood control measure is designed for, as determined by engineering feasibility, economic criteria, and social, environment, and other considerations.
Dike	An embankment to confine or control water.
Diversion channel	(1) An artificial channel constructed around a town or other point of high potential flood damages to divert floodwater from the main channel to minimize flood damages. (2) A channel carrying water from a diversion dam.
Earthfill dam	A dam, the main section of which is composed principally of earth, gravel, sand, silt and clay.
Flood capacity	The flow carried by a stream or floodway at bankfull water level. Also, the storage capacity of the flood pool at a reservoir.

Floodplain	Valley land along the course of a stream which is subject to inundation during periods of high water that exceed normal bankfull elevation.
Flood proofing	Techniques for preventing flood damage to the structure and contents of buildings in a flood hazard area.
Groin	A wall like structure built perpendicular to the shore to trap sand and prevent beach erosion.
Habitat	The total of the environmental conditions which affect the life of plants and animals.
Harbor of refuge	A harbor provided at an inhospitable coastline to allow vessels to shelter during storms.
Headwaters	(1) The upper reaches of a stream near its source. (2) The region where ground water emerges to form a surface stream. (3) The water upstream of a structure.
Impervious blanket	A covering of relatively waterproof soils, such as clays, through which water percolates at about one millionth of the speed with which it passes through gravel.
Jetty	A structure similar to a groin built on a seashore to prevent erosion due to currents and tide.
Left or right bank of river	The left hand or right hand bank of a stream when the observer faces downstream
Levee	A dike or embankment, generally constructed close to the banks of the stream, lake, or other body of water, intended to protect the land side from inundation or to confine the streamflow to its regular channel.
Low flow augmentation	The increase of water flows to more desirable volumes above the natural stream flows.
Mouth of river	The exit or point of discharge of a stream into another stream, a lake, or the sea.
Navigable waters of the United States	Those waters of the United States subject to the ebb and flow of the tide shoreward to the new high water mark.
Penstock	A sluice or gate used to control a flow of water.
Pierhead line	The line in navigable waters formerly used to delineate waterward limits of blanket permit authority for open pile structures. This authority was rescinded May 27, 1970, and permits are now required for all construction in navigable waters of the United States.
Reach	A length, distance, or leg of a channel or other watercourses.
Reservoir	A pond lake, lake, tank, basin, or other space, either natural or created in whole or in part by the building of a structure such as a dam, which is used for storage, regulation, and control of water.

Revetment	(1) A facing of stone, concrete, or sandbags to protect a bank of earth from erosion. (2) A retaining wall.
Revetted Levee	A stone or concrete faced embankment raised to prevent a river from overflowing.
Riprap	A layer, facing, or protective mound of randomly placed stones to prevent erosion, scour, or sloughing of a structure or embankment. Also, the stone so used.
Rock dike	An embankment built principally of rock.
Rubblemound	A type of breakwater built of large quarried rock dumped on top of each other and built to an elevation that storm waves would not overtop.
Seawall	A concrete, stone, or metal wall or embankment constructed along a shore to reduce wave erosion and encroachment by the sea.
Setback levee	A levee that is constructed away from the water's edge.
Shoal	A place in any body of water where the water is especially shallow.
Sill	(1) A horizontal beam forming the bottom of the entrance to a lock. (2) Also, a low, submerged dam-like structure built to control riverbed scour and current speeds.
Spall	A fragment or flake from stone or ore.
Spillway	A waterway or dam or other hydraulic structure used to discharge excess water to avoid overtopping of a dam.
Stage	The elevation of the water surface above or below an arbitrary datum.
Standard project flood	A flood that may be expected from the most severe combination of meteorological and hydrological conditions that are reasonably characteristic of the geological region involved excluding extremely rare combinations.
Tide box	A gravity drainage structure with a one-way valve.
Toe drain	A filter on the free side of a dam or levee at the lower end to protect it against piping, or seepage of water carrying materials.
Tributary	A stream or other body of water that contributes its water to another stream or body of water.
Wetlands	Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support — and that under normal circumstances do support — a prevalence of vegetation typically adapted for life in saturated soil conditions.

Index

A	Page	F	Page
Albeni Falls Dam	73	Foreword	i
American Falls	82		
Anderson Ranch Dam	43	G	
Arrowrock Dam	43	Glossary	83
Authorization and Planning Process for Water Resource Projects	1	Gooding Area Flood Protection	49
B		H	
Bear Creek, Kendrick	29	Heise Area Levees	24
Bear River Basin	69	Heise-Roberts Levee Extension	24
Big Lost River Basin	53	Hells Canyon	20
Big Wood River Basin	49	Henrys Fork River Basin	67
Blackfoot Area Levees	23		
Blackfoot Reservoir Modifications	61	I	
Blackfoot River Basin	61	Idaho Water Facts	iv
Blackfoot River Levees	61	Independent Projects of other Agencies	81
Bliss	81		
Boise River Basin	41	J	
Boise Valley Levees	41	Jackson-Palisades Project	24
Brownlee Dam	20		
C		K	
C. J. Strike	81	Kootenai River Basin	77
Civil Works Map	88		
Civil Works Overview	1	L	
Clark Fork, Lightning Creek	74	Lapwai Creek, Culdesac	29
Clark Fork-Flathead River Basin	74	Lewiston-Clarkston Bridge	23
Clearwater River Basin	29	Libby Recreation Areas	78
Coeur d'Alene Lake	71	Little Wood River	81
Columbia River Treaty with Canada	11	Lower Granite Lock and Dam	20
Comprehensive Basin Studies	10	Lower Salmon	81
Contents	v	Lower Snake River Fish and Wildlife Compensation Plan	10
D		Lucky Peak Lake	42
Devil Creek	82	Lyman Creek Basin Levees	65
Dworshak Dam and Reservoir	29		
Dworshak Fish and Wildlife Compensation	31		

M	Page	T	Page
Major River Basins	17	The Columbia-Snake Inland Waterway	19
Milner	81	Tomanovich-Salmon City Levees	35
Minidoka	81		
Mission Creek	29	U	
Mud Lake	55	Upper Salmon	81
N		W	
Navigation	2	Weiser River Basin	37
Navigation - Lewiston to Johnson Bar Landing	23	Weiser River Flood Protection Project	37
North Pacific Division	8	Whitebird Creek Levees at Whitebird	35
		Willow Creek Basin	63
O			
Owyhee River Basin	47		
Oxbow	20		
P			
Palouse River Basin	27		
Payette River Basin	39		
Payette Valley Flood Protection Project	39		
Pend Oreille River Basin	73		
Placer Creek	71		
Pocatello Levees and Channel Improvements	57		
Portneuf River Basin	57		
Portneuf River Environmental Restoration Project	58		
Potlatch River, Kendrick	29		
Priest Lake Outlet Structure Study	75		
Project Initiation	6		
R			
Ririe Dam and Lake	63		
S			
Salmon River Basin	35		
Salmon River Flood Damage Reduction Study	35		
Shelley Area Revetment	23		
Snake River Main Stem	19		
Soldier Creek Environmental Restoration Project	50		
South Fork Clearwater River Levees	33		
Spokane River and Tributaries	71		
Spokane River Basin	71		
St. Maries, St. Joe River	71		
Swan Falls	81		

	<input type="checkbox"/> Multipurpose projects	<input type="triangle"/> Flood control projects	<input type="circle"/> Navigation projects
Completed Projects	<p><i>Pend Oreille River Basin</i> 1. Albeni Falls Dam, Pend Oreille River</p> <p><i>Clearwater River Basin</i> 2. Dworshak Dam-North Fork Clearwater River</p> <p><i>Snake River Main Stem</i> 3. Lower Granite Lock and Dam 4. Lewiston-Clarkston Bridge</p> <p><i>Blackfoot River Basin</i> 5. Blackfoot Reservoir-dam levee modification (construction by Bureau of Indian Affairs)</p> <p><i>Boise River Basin</i> 6. Lucky Peak-Powerhouse (Boise Board of Control)</p> <p><i>Willow Creek Basin</i> 7. Ririe Dam</p>	<p><i>Kootenai River Basin</i> 1. Kootenai Flats-levees near Bonniers Ferry</p> <p><i>Pend Oreille River Basin</i> 2. Clark Fork, Lightning Creek levees near town of Clark Fork</p> <p><i>Spokane River Basin</i> 3. Coeur d'Alene-levees and flood walls 4. St. Maries, St. Joe River levees and flood walls 5. Wallace-Placer Creek concrete channel</p> <p><i>Clearwater River Basin</i> 6. Kendrick-Bear River levees 7. Kendrick-Potlatch River levees 8. Culdesac-Lapwai Creek levees 9. Mission Creek-levee and channel enlargement near St. Joseph's Children's home</p> <p><i>Salmon River Basin</i> 10. Tomanovich-Salmon city levees</p> <p><i>Boise River Basin</i> 11. Lucky Peak Lake-Boise River</p> <p><i>Portneuf River Basin</i> 12. Pocatello-levees and channel improvement</p> <p><i>Blackfoot River Basin</i> 13. Blackfoot River-levees</p> <p><i>Snake River Main Stem</i> 14. Blackfoot area-levees 15. Shelley area-revetment 16. Heise-Roberts area-levees and extension</p> <p><i>Lyman Creek Basin</i> 17. Lyman Creek-levees</p> <p><i>Big Wood River Basin</i> 18. Gooding Levees</p>	<p><i>Snake River Waterway</i> 1. Lewiston to Johnson Bar</p>
Not Started	<p><i>Camas and Beaver Creeks</i> 1. Mud Lake levee modification (deferred)</p>	<p><i>Weiser River Basin</i> 1. Weiser River-flood control (deferred)</p> <p><i>Big Wood River Basin</i> 2. Little Wood River at Gooding-Shoshone, Idaho, diversion and levees</p> <p><i>Salmon River Basin</i> 3. Ice Jam flood control</p>	

CORPS OF ENGINEERS CIVIL WORKS PROJECTS STATE OF IDAHO 1995

LEGEND COMPLETED

Dams, Reservoirs and Bridges

Levee and Channel Improvements

Navigation Projects

